Carlson Software 2007

Volume 1

Introduction
General Commands
Tutorials
Programming Interfaces

Carlson Software Inc.

User's manual

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Introduction

Introduction

Carlson 2007 is application software for land development, civil engineering, surveying, construction, GIS and mininig engineering which runs with AutoCAD. AutoCAD serves as the graphics engine and drawing editor for Carlson. Carlson 2007 work inside AutoCAD and use AutoCAD's user-interface, menus, and dialog boxes. Essentially, Carlson is an extension of AutoCAD that customizes AutoCAD for your specific discipline with additional commands.

Carlson 2007 consists of the following programs: Survey, Civil Design, Hydrology, GIS, Carlson Field, Takeoff, Natural Regrade, Point Clouds, Basic Mining, Geology, Underground Mining, Surface Mining and Blasting. Each of these programs can run independently or together with each other.

Carlson 2007 supports the LandXML format by providing conversion of design files to and from LandXML. For more on LandXML, visit http://www.landxml.org.

Carlson Directory Structure

The figure below shows the default directory structure for the Carlson program files. The EXEC, LSP, and SUP sub-directories have files that are accessed by the program. You should never need to access these files directly yourself. The DATA and WORK sub-directories are the user's directories.

ROOT

\Carlson2007

\EXEC

Executables
- Programs (.EXE, .DTA)

\SUP

Support
- Drawing blocks (.DWG)
- Menus (.MNU, .MNX)

\LSP

Lisp & ARX
- Programs (.LSP, .DLL, .ARX, .DCL)

\DATA

User data files
- Survey files (.RW5, .CRD, etc)

\WORK

Startup directory, user drawings
- Drawings (.DWG)

\USER

User setup files
- Settings files (.INI)

System Requirements

Carlson's system requirements are no greater than that of the AutoCAD version you are running. See your AutoCAD installation guide for minimum system configuration. It is always recommended that you use the highest performance PC possible.

Note: Carlson does require a minimum screen resolution of 800x600.

Carlson 2007 will operate with the following versions of AutoCAD:

- AutoCAD 2007/2006/2005/2004/2002/2000i/2000
- AutoCAD Map 2007/2006/2005/2004/R6/R5/R4.5/R4
- Land Development Desktop 2007/2006/2005/2004/R3
- Civil 3D 2007/2006/2005

Installing Carlson

Please refer to the installation guide included in the Carlson package for the latest installation instructions. To complete the Carlson installation, start Carlson and complete the registration process as explained in the following sections.

For more installation options in the future, refer to the Carlson Software download page on our website at http://www.carlsonsw.com.

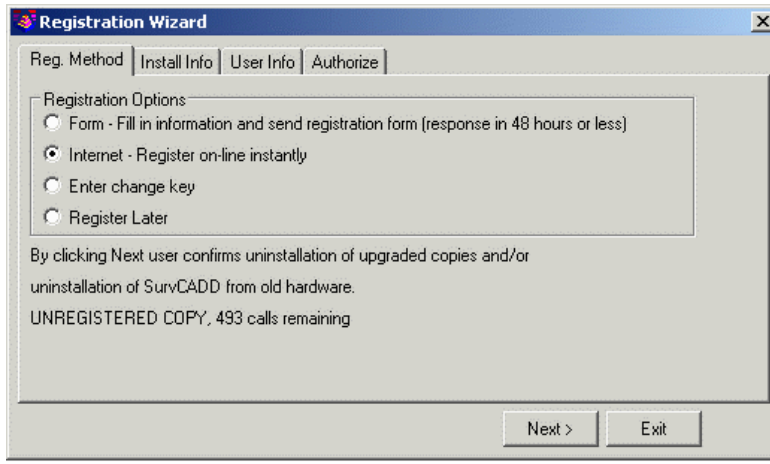
Starting AutoCAD with Carlson

To start Carlson, use the icon which was created on your desktop and in Carlson submenu under Start > Programs (or All Programs). When you do so, AutoCAD is started with a customized profile, which contains all of the setting changes necessary to run Carlson. This profile prevents harmful conflicts between Carlson and other AutoCAD based products. The changes in menus, tool bars and preferences will be saved in that profile for further use.

Carlson Registration

Each Carlson program is licensed for use on **one** workstation which must be registered. The registration records your company name and AutoCAD serial number. To register your copy of Carlson, start Carlson and choose "Register Now". The following dialog will appear.

Note: Carlson Software will no longer issue change keys over the telephone. There are four registration options.


Registration Wizard
Reg. Method
Install Info
User Info
Authorize
Registration Options
Form - Fill in information and send registration form (response in 48 hours or less)
Internet - Register on-line instantly
Enter change key
Register Later
By clicking Next user confirms uninstallation of upgraded copies and/or
uninstallation of SurvCADD from old hardware.
UNREGISTERED COPY, 493 calls remaining
Next >
Exit

Fax: This method allows you to print out the required information on a form which you then fax to Carlson Software. The fax number is printed on the form. The change key will be faxed back to you within 72 hours.

Internet: Register automatically over the Internet. Your information is sent to a Carlson Software server, validated and returned in just a few seconds. If you are using a dial-up connection, please establish this connection before attempting to register.

Enter pre-authorized change key: If you originally chose the Fax method above, you will need to choose this method now to enter the change key that is faxed back to you.

Register Later: If you wish, you may defer registration up to 30 days. After this time, Carlson will enter demo mode which displays a message each time a Carlson command is run.

After you select the registration method, choose Next and select the type of installation you are performing, choose Next again to review the copyright information and to fill out the required information. At this point, if you are using the Fax method, press the Print Fax Sheet button. If you are registering using the Internet method, press Next and the process will start.

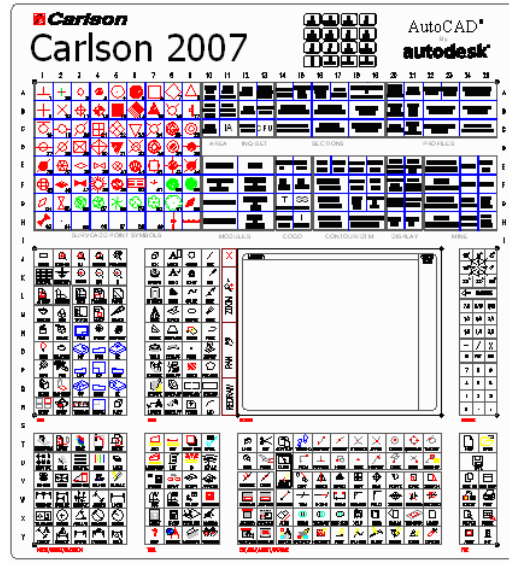
If you have any problems with Internet registration, please repeat this process and use the Fax method. There is more registration information on the Carlson Software website at http://www.carlsonsw.com/registration.html.

Tip: If Carlson is running, you may access the registration dialog by choosing *About Carlson* from the Help menu, then pick the Change Registration button.

Tablet Template

If you have a digitizer you will probably want to plot a copy of the Carlson tablet menu. After installing Carlson, start AutoCAD and plot a copy of the drawing file TABLET.DWG located in the Carlson support directory (i.e: \Carlson2007\SUP\TABLET.DWG), at a scale of 1=1. You may want to review the drawing in the drawing editor to determine layer names and colors to set up a color version of the template. You can also modify this drawing to add your own symbols and details to the tablet menu. After plotting, secure the Carlson template drawing to your digitizer. The proper scale is 1=1 for a 12" x 12" tablet. It can also be plotted at a smaller or larger scale to suit other tablet sizes.

Once you have a hard copy of the tablet, AutoCAD needs to be configured for the tablet. Type TABLET at the AutoCAD command prompt. Refer to the AutoCAD Reference Manual for details on the menu area points and number of columns and rows. The tablet template is in the standard AutoCAD template format which means if you are using any of Autodesk's other templates you can easily switch between different control menus.



Troubleshooting Setup

To install Carlson 2007 on Windows NT4.0, Windows 2000, or Windows XP, you must have Administrator permissions to write to the system registry during the install.

Successful install of Carlson consists of four key items:

1. Windows registry settings
2. Carlson icon on desktop and in the Start menu
3. Carlson 2007 profile created in AutoCAD
4. carlson.ini configuration file in USER sub-directory of Carlson

If you have trouble starting or running Carlson 2007 after installation, using Windows Explorer, go to the Carlson \USER directory and run the **SCJSTART.EXE** executable. To open Windows Explorer, click Start, point to All Programs, point to Accessories, and then click Windows Explorer.

If this does not fix the problem, please re-install the software making note of any possible error messages before contacting Technical Support.

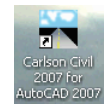
Desktop and Menu cons for Carlson 2007

A Carlson specific profile is used in order to configure Carlson correctly and start the Carlson

menu when AutoCAD starts. Profiles are used by AutoCAD to separate different product environments.

The profile to use with AutoCAD is supplied by the Carlson startup program. To verify that your Carlson icon is set up correctly, do the following:

- Right click on the Carlson icon and select Properties. Click on the Shortcut tab.
- Target field should contain the following executable **SCJSTART.EXE** (located in the Carlson\USER directory).
- Work directory defaults to the same directory where drawings are stored
- Make changes as needed and click OK.



Checking Carlson.INI configuration file.

The last step in troubleshooting the installation is to verify the Carlson.INI file in the Carlson USER directory. Open that file using Notepad (Click Start, Programs, Accessories, Notepad) or

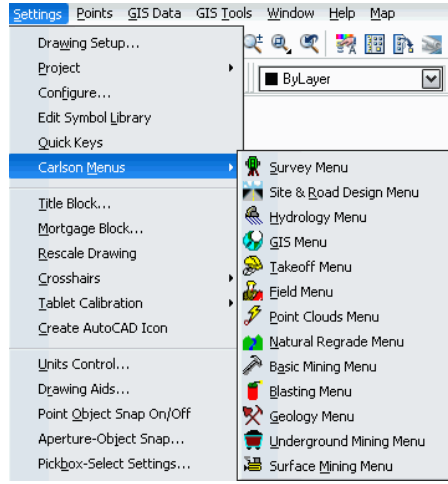
any other editor. Then verify and/or modify the top few lines to match your setup. Save it and restart Carlson.

If the procedures outlined above did not help or you have trouble following them, please feel free to contact Carlson Software Tech Support.

Loading Carlson Menus

The Carlson programs are loaded when the Carlson menu is loaded. The Carlson menu is named cs##base.mnu (for AutoCAD 2005 and earlier) or cs##base.cui (for AutoCAD 2006 and later) where the ## is the version of AutoCAD. For example, in AutoCAD 2007 the Carlson menu name is cs07base.cui. The Carlson menu is located in the Carlson SUP folder. The Carlson installation and desktop icons should automatically setup AutoCAD to load the Carlson menu. To manually load the Carlson menu, first make sure that the Carlson SUP folder is listed in the Support File Search Path under AutoCAD Options. Then run the menuload or cuiload AutoCAD command and load the Carlson menu.

The Carlson menu has over 50 pull-down menus for the different Carlson programs. Each program has it's own set of pull-down menus. The menu set for one program is active at a time. To switch current program menu, choose the menu from Settings>Carlson Menus or choose from the Modules toolbar.



Obtaining Technical Support

via Discussion Groups

- Carlson Software operates user discussion groups located at news://news.carlsonsw.com. You can participate in user-to-user discussion on tips, tricks and problems. Our staff monitors these groups to ensure that all the issues are addressed. Visit our website at http://www.carlsonsw.com for information on how to access these groups.
- You may also access the Carlson Software Knowledge Base. Visit it directly at http://update.carlsonsw.com/kbase_main.php.

via Electronic Mail

- The Technical Support e-mail address is support@carlsonsw.com.

via Phone/Fax

- Phone: (606) 564-5028
- Fax: (606) 564-6422

via Web Site

Check the Carlson Software Web Site at http://www.carlsonsw.com for:

- Knowledge Base, discussion groups, technical support documents and newsletters

Carlson Software manuals (PDF) and training movies

- Training and seminar schedules
- Step by step procedures on popular called-in topics
- Carlson Software and Autodesk downloads and updates (Feel free to register for automatic update notification of updates when you come to that area.)

Command Entry

Commands may be issued by selecting a pulldown menu, screen menu, digitizer tablet item, or by typing a command at the AutoCAD command prompt. Pressing Enter at the command prompt repeats that last command. Pulldown menus have a row of header names across the top of the screen. Selecting one of these header names displays the possible commands under that name. Screen menu items are shown in the screen menu (typically on the right side of the screen). The screen menu can be toggled off and on inside of the AutoCAD Preferences dialog. The Pulldown menus are the primary method for Carlson command selection. Each section of this manual shows the pulldown menu which contains the commands that are explained in that section. Pulldown menus are sometimes also referred to as dropdown menus.

Command availability depends on which menu is loaded. Carlson menus have a mixture of both Carlson and AutoCAD commands. This allows you to execute the commonly used AutoCAD commands from the menus while running Carlson.

Quick Keys are user-defined short cut names that can be typed in to start commands. To review the current set of Quick Keys, run the Quick Keys command in the Settings pulldown menu. Quick Keys are explained in more detail in the next section.

What is New

General Commands

- ***New* Project Setup** - Added ability to define data and drawing folders to associate with drawings. User-defined data folders can be specified for each data file type.
- **Drawing Cleanup** - Added several new functions such as removing overlapping polyline loops and fixing extruded arcs and text.
- **File Selection** - For all data file selection, added folder manager to set favorite folders for data files.

- **3D Viewer Window** - Added ability to edit entity layers and elevations and to create selection sets.
- **Transparent Commands** - New transparent command of 'CL for specifying a position by station-offset from a centerline at any point prompt. Created a new transparent command toolbar with this new station-offset command along with the existing '2 and '3 for 2D and 3D points by coordinate file point number commands.
- ***New* Layer Inspector** - New command to highlight, isolate and/or zoom to layers selected from a docked list.
- **Report Formatter** -Added more controls for sorting fields.
- ***New* Selection Set By Elevation** - New command to create a selection of entities within a specified elevation range.
- **Add Points At Elevation** - Inserts vertices into a 3D Polyline at a specific elevation or elevation interval by interpolating between existing elevations in the polyline.
- **Draw 2D Polyline** - Added method to enter initial distance and use cursor direction to start the polyline. Added method to specify reference centerline and enter points by station-offset. Added option to enter distances in feet and inches within extend mode. New option to label elevation of polyline.
- **Highlight Crossing Breaklines** - Added option for tolerance of elevation difference to report and option to merge 3D polyline with contour elevations.
- **Remove Arcs Offset** - New settings in Configure to control spacing on replacing arcs with chords.
- ***New* Variable Offset** - New command to offset a polyline with different offset amounts for each polyline segment.
- ***New* Move Text** - New command to slide text parallel or perpendicular to current rotation.
- **Insert Symbols** - New dialog interface for pre-defined layer, size and rotation.
- ***New* Block/Insert Rotate** - New command to set the angle of blocks by various methods.
- ***New* Copy Polyline Section** - New command to copy a portion of a polyline at the specified points and put copied portion on another layer.
- **Align To Nearest Line** - In Twist Point Attributes, Rotate Text and Rotate Inserts, added method to select multiple alignment polylines and align the objects to the nearest segment.

Survey Commands

- **Point Protect** - Added point history review, comparison of old and new coordinates and option to list points to the point protect dialog.
- **SurvCOM** - Added ability to transfer a range of points from a coordinate file and merge coordinate files with a new Merge Point Manager to handle any point number conflicts. For file overwrite protection, added ability to rename the files.
- ***Hot* Field To Finish** - New codes for creating 3D objects (building faces, walls, blocks, etc) using 3D faces. Added function to define a simple template to apply along linework.

New code setting to control whether points are used for surface modeling in Triangulate & Contour. Also new code setting to create point groups by code. Added new setting for elevation label prefix and suffix per code and for all points. For data points report, added option to report only points with undefined codes. For codes report, added method to only report codes that are used in the current coordinate file. Added new special code for creating circles. Added support for PC-PT curves defined by two points and using tangents in/out. Added code settings to control the linetype spacing and size.

- ***Hot New*** **Field To Finish Inspector** - New command to review entities in the drawing by Field To Finish code. Point descriptions can be edited and the drawing is updated for both the point symbols and linework using the Field To Finish coding.
- **Edit-Process Raw File** - Added support for COGO commands of translate, rotate, scale and align. Added ability to use a separate control coordinate file to use as reference for station setups and for check point reporting. Added option to specify the traverse control points in a list of the points and with a graphic preview. With graphics window, new feature to highlight graphic lines and points for the selected spreadsheet record and likewise the associated spreadsheet record will highlight when a line or point is selected in the graphic view. Reorganized reports with sideshots and closure active to show the closure at the top of the report and report the traverse shots separately from the sideshots. Added more details for the Check Points report. For the modify measurements function, any changes are recorded to the rw5 file and added an option for a description filter. On processing, when a referenced backsight point doesn't exist, the program has options to enter the backsight coordinates, enter the backsight angle or return to the editor. Added startup option whether to prompt for the rw5 file and added an exit option whether to automatically save changes to the coordinate file or prompt to save. Added a toolbar within the editor for common functions. Added another spreadsheet color setting for different colors between traverse and sideshot measurements.
- ***Hot*** **SurvNet** - New interface as separate command with option for graphics view. Improved processing speed. Improved 3D adjustment model. Added support for level data into 3D adjustment. Added support for control points and multiple angle sets from rw5 files. Improved initial coordinate calculations to handle two or more control points anywhere in job. Added support for Topcon .TVF vector files. Added support for LandXML GPS vector data. Added the averaging of the same control point coordinates while preprocessing data. Added import for Topcon digital level data.
- **Distance and Angle Input** - All COGO input fields for distances and angles support reading point numbers, units conversion and processing formulas.
- **Edit Points** - Added undo function. Added ability to sort by any of the columns in the spreadsheet.
- **Edit Point Attributes** - Added setting for the elevation label decimal places.
- **Edit Multiple Point Attributes** - Added selection method to pick point by point group or

point numbers. Added setting to control the decimal places for the elevation labels.

- ***Hot New*** **Coordinate History** - All changes to the coordinate file record the command and status to make a coordinate history that can be reported by point number or by command. Commands like Drawing Inspector and Point Snap show the most recent history for each point. All changes can be rolled back.
- ***New*** **Move Point With Leader** - New command to move point attribute labels and draw dynamic leader to point node.
- ***Hot New*** **Fix Point Attribute Overlaps** - New command to adjust point attribute labels to avoid overlapping labels. Applies adjustment methods in user-specified order and tolerances. Steps through any remaining overlaps in an Overlap Manager with ability to manually move labels. This point overlap feature is also available within the Draw-Locate Point and Field To Finish commands.
- **Scale Points** - For the combined factor method, added the option to apply the geoid for the ellipsoid height for the elevation factor.
- **Import Text/ASCII File** - Added option to draw imported points by Draw-Locate Points or Field-to-Finish.
- **Export Text/ASCII File** - Added option to output point note data.
- **Coordinate File Utilities** - Added Helmert 7-parameter method for local transformations. Added function to swap northing-easting within the coordinate file. New Merge Points Manager for handling point conflicts when combining coordinate files.
- ***New*** **Linework Intersection Points** - New command to create points at all the intersections between the selected linework entities.
- **Interval Along Entity** - Added option whether to label elevations on the new points and added option to set same description to all the points.
- **Label Station Offset** - Added options whether to label parallel or perpendicular to the centerline and whether to draw leader.
- **Offset Point Entry** - Added method to enter increment distances. Added option for cross slope percent and vertical delta-z when using a reference elevation.
- ***New*** **Set Point Elevation By 3D Polylines** - New command to assign elevations to points by referencing 3D polylines.
- **Closure By Point Numbers** - Added support for entering a range of points or point group.
- ***Hot New*** **Deed Reader** - New command to extract deed line and curve data from the text of a deed. Shows the deed data in a spreadsheet and graphically. Deed data can be saved to deed file, drawn and reported.
- **Process Deed File** - Changed deed editor to a spreadsheet with dynamic graphic window to show deed perimeter.
- ***New*** **Deed Linework ID** - New commands to report deed name associated with selected linework. Deed commands that draw deeds now attach the deed name to the linework.
- **Deed Correlation** - Added the ability to apply the alignment to the points and select draw-

ing entities. New report function to compare the survey and deed points before alignment. Added delta x,y to the Check Align report.

- **Lot Layout** - Added method to specify number of lots to equally divide whole area between them. Added method to define backlot by max setback distance instead of linework.
- **Create Lots** - Added the option to draw any new points for all the Create Lot routines.
- ***New* Lot File By Interior Pick** - New command to create a lot by picking a point and having the program figure the enclosing linework.
- ***Hot New* Lot File Manager** - New command that combines Input-Edit Lot, Draw Lot and Report Lot into one command. New spreadsheet data entry for lot data with dynamic graphic preview. Added functions to change direction of the lot, to change the point of beginning for the lot and to save and load lot name selections.
- **Label Coordinate** - New option to label the delta x,y and/or z between two points. Added setting to draw label at real z.
- **North Arrow** - Improved interface with dialog options and better default scale.
- **Area By Closed Polylines** - Added option to link polyline to area label and update label when polyline is modified. Added setting to auto-center labels.
- ***New* Area Tables** - New routines to define, create and edit area tables.
- ***New* Area Descriptions** - New routines to assign and report area descriptions.
- ***Hot* Auto-Annotate** - Added option to set line label positions by inside/outside of closed polyline. For line and curve tables, added option to combine table entries with same data values. For tight fitting labels on curves, added option to label curve fields that fit on curve and rest in curve table. Added option to label interior and exterior angles between adjacent line segments.
- ***New* Draw Endpoint Leaders (Pick Side)** - New command for placing crow's feet on selected side of line segment.
- **Annotate Bearing/Azimuth** - Added settings for prefix and suffix to angle labels.
- **Custom Label Formatter** - Added method to enter quick-key style keywords to quickly change label format.
- **Stack Label Arc** - Added setting to justify label left or right.
- **Line/Curve Tables** - For AutoCAD 2005 and higher, added option to use new AutoCAD table entity. Added option to combine table entries with the same data to share a table number.
- ***New* Mirror & Flip Selected Labels** - New command to both flip and mirror the selected annotation labels.
- **Special Leader/Leader With Text**- Added options to set text position and alignment.

Civil Design Commands

- **Grid Models** - Improved the memory management for large grid files to make more use of the available computer memory.

- **Triangulate & Contour** - Improved speed by 33% and improved memory usage 25%. Added processing option to simplify the triangulation by a user-specified tolerance. Added setting to control line width for intermediate contours.
- **Surface Manager** - Added ability to add a surface into the manager by selecting a triangulation file.
- **Triangulation File Utilities** - Added function to Enhance Flat areas and improved routine to Simplify (reduce) triangulation. Added method for Merge tin's to erase old tin under new tin and re-triangulate the gap.
- **Design Pad Template** - Added the option to use an interior triangulation surface for the pad design surface and on editing the pad, there is an option to apply the adjustments to this interior surfaces along with selected drawing entities. For slope groups, added ability to transition between different slopes, method to assign group between specified points and ability to save and load slope group settings.
- ***Hot*** **Edit Pad Template** - Redesigned as docked-dialog with ability to apply changes while still in command. Added function to balance pad and function to rotate pad. Also added support for double-click on pad entities to run Edit Pad Template.
- **Fillet 3D Polyline** - Added method to fillet two 3D polylines at their intersection with elevation transition along the fillet between the two polylines. Applies to merging edge of pavement polylines at road intersections.
- ***New*** **Merge Crossing 3D Polyline** - New command to merge a main 3D polyline with a side 3D polyline at their intersection by adjusting the elevation of the side polyline with the option for a vertical curve transition. Useful for merging 3D polylines of road centerlines at intersections.
- **2D To 3D Polyline By Surface Model** - Added tolerance for picking up T-intersections.
- **Volumes By Triangulation** - Improved speed to be twice as fast.
- **Contour Elevation Label** - Added options to set break offset distance, label style and label index contours only.
- ***New*** **Move Label Along Contour** - New command to slide a contour elevation label along the polyline.
- **Elevation Zone Analysis** - Added option to subdivide 3D faces that cross zone boundaries for higher resolution.
- **Slope At Points** - Added option to label slopes in all surface triangulations and option whether to draw labels.
- **Cut/Fill Color Map** - Added option for custom colors and option to draw color map as 3D faces at real z.
- ***New*** **Color Contours By Interval** - New command to set the contour polyline colors based on the elevation interval.
- ***New*** **Label Pad Elevation** - New command to label the elevation of the selected polylines.
- **Label Polyline Segment** - Added option to label each segment of the entire polyline.

- **Elevation Difference** - Added more labeling options to the triangulation surface method.
- **Story Stake Report**- Added another report format option for all data for each story on the same row.
- **Double-Click Editing** - Double-clicking on centerline, profile and section drawing entities will start up the associated editor for that data file.
- **Centerline Reactor** - Added option to link centerline polyline with centerline .cl definition to update the .cl file when the polyline is modified.
- **Input-Edit Centerline** - Added horizontal curve speed tables and radius calculator. New function to fit curve between two line segments. Within the routine, added method to select centerline by screen polyline. Also added support for double-click on centerline polyline to run centerline editor. Added ability to select centerline points from point list or screen pick including the curve PI point.
- **Draw Centerline** - Added option to draw lines at curve PI.
- **Input-Edit Profile** - Added vertical curve tables with more default tables plus ability for user-defined tables. When a reference profile is active, the Check Stations and graphic window report the cut/fill with the current profile and the elevation of the reference profile.
- ***Hot New* Road Network** - New command to process multiple road designs with intersections and cul-de-sacs.
- **Road Design Inspector** - Added options to select second profile and section for reference.
- ***Hot New* Input-Edit Road Profile** - New command for designing and editing road profiles with dynamic profile, centerline and section views. Includes smart PVI editing tools.
- ***Hot* Draw Profile** - New streamlined user-interface. Added ability to save and load profile settings. Added settings for colors, text styles and linetypes for profile lines and labels. Added options to label break point stations, elevations and description, and horizontal axis elevations. For sewer profiles, added an option to prompt for dimensions of each manhole. Also for sewer profiles, added option to label descriptions and added separate settings to control label precision for pipe lengths and slopes, rim and invert elevations and stations. For the horizontal label box, all the fields are user-defined for the sequence, size, layer and style.
- **Point Placement On Profile** - Added settings for prefix and suffix labels for station and elevation.
- **Profile To 3D Polyline** - Added option to station by a separate reference alignment.
- **Profile To Points** - Added option to station by a separate reference alignment.
- **Profile Report** - Added an option to use the Report Formatter for ground and road profile reports. Also for road reports, added an option whether to report the PVC/PVT stations.
- **Station-Elevation-Slope Report** - Added settings for prefix and suffix labels and label size for station, elevation and slope. Added option to draw symbol. Added method to pick station-elevation position to label without reference along a profile.
- ***Hot* Draw Section** - Improved parameter input to make section layout easier especially

for sheets. Added preview function in the sheets setup dialog. Added settings for colors, linetypes and text styles. Added option to link drawn section entities with section files to update drawn entities when the section file is modified. Added support for double-click on drawn section to launch section editor. Added graphical selection for description match for break point label options. Added option to label description from section point files such as ROW section files.

- **Input-Edit Section File** - Improved editing of subgrade to link relative offset and slopes of subgrades with surface grades. New methods to update tie points. Added function to interpolate stations by range and interval. For interpolate new sections, added option to use reference profile for more accurate control of elevations.
- **Quick Section** - Added options for interpolation methods and whether to use descriptions by layer.
- **Section Report** - Added option for user-defined offsets to report and added graphical selection of descriptions to report.
- **Calculate Section Volume** - Added option to report using the report formatter. Added report option to show cut/fill ratio and balance at each station.
- ***New* Input-Edit End Area File** - New command for entering stations with cut/fill end areas in simple spreadsheet.
- **Section To 3D Polylines** - Added option to use reference profile for more accurate interpolation of elevations.
- **Assign Template Point Profile** - Added method to station by main centerline or template point. Also added option to select reference template for selecting template id's from a list.
- **Input-Edit Superelevation** - Added function for a report of the superelevation stations and slopes. Added graphics to show superelevation stages.
- **Input-Edit Template Series** - Added option to not transition between templates.
- **Draw Typical Template** - Added setting for vertical exaggeration.
- **Process Road Design** - For the first dialog with the road design file setup, added functions to edit each type of road design file. For template cut benches, added support for triangulation surfaces for bench target in addition to section files. Added output option for existing ground sections for when triangulation is used as existing ground. New option to edit design sections before final report and output. Added graphical selection method for choosing template and subgrade ids to draw. Added settings to control colors of triangulation output. Added option to report using the report formatter. Added report option to show cut/fill ratio and balance at each station.
- ***New* Mass Haul Report** - New command to report mass haul amounts and stations of balance.
- ***Hot New* Mass Haul Analysis** - Calculates optimal movement of cut to fill volumes with option to set borrow pits and dump piles. Reports haul distances by range.

Hydrology Commands

- ***Hot New*** **Watershed Analysis** - New command to determine watersheds of a triangulation surface with several tools including draw watershed boundaries and sinks, inspect watershed with data at current cursor position, report watershed data, draw flow connections, runoff tracking for specified flow amounts, and watershed above point. Added ability to add and edit structures to the watershed model for inlets, channels and culverts.
- ***New*** **Hydro-35** - Added rainfall maps for Hydro-35.
- **Edit Layout Element** - Changed interface to use spreadsheet for data entry of stage-storage-discharge data.
- **Pipe Culvert Design** - Redesigned to support more flow control methods, more inlets and support box culverts.
- **Sewer Pipe Design** - Added method to read pipe dimensions from selected segment of sewer network. Added function to draw detail of the pipe segment.
- ***New*** **Orifice Design** - New command to design circular and rectangular orifices.
- ***New*** **Advanced Weir Design** - New command to design weir spillways.
- **Input-Edit Stage-Storage** - Added stage-storage input by design parameters for rectangular ponds, irregular ponds and underground pipes. The user-defined stage-storage data input uses a spreadsheet.
- ***New*** **Multiple Outlet Design** - New command to combine groups of Orifice, Weir, Drop Pipe, Culvert or user-defined outlets and design the overall flow.
- **Input-Edit Stage-Discharge** - Changed interface to use spreadsheet for data entry. Added graph function.
- ***New*** **Import Flow Velocity Points** - New command to import Hec-Ras velocity data.
- ***New*** **Import Flow Depth Points** - New command to import Hec-Ras depth data.
- ***New*** **Inlet Symbol Library** - New category of inlet and manhole symbols in the default symbol library.
- ***New*** **Inlet Library** - New command to store parameters for curb, gutter and slotted inlets to use in the sewer network.
- ***New*** **Rainfall Library** - New command to store rainfall intensity by time for various storms for the sewer network.
- ***New*** **Sewer Structure Library** - New command to store dimensions and types of sewer structures.
- ***New*** **Pipe Size Library** - New command to store pipe sizes to use in the sewer network.
- ***New*** **Pavement Manning's N Library** - New command to store manning's N for surfaces to use in the sewer network.
- ***New*** **Pipe Manning's N Library** - New command to store manning's N for pipes to use in the sewer network.
- ***New*** **Drainage Runoff Library** - New command to store runoff coefficients to use in the

sewer network.

- ***New*** **Define Runoff Layers** - New command to define runoff coefficients for different areas by layer name. Sewer networks can then use closed polylines on these layers to automatically calculate the sub-areas within the drainage and find the weighted average for the runoff coefficient.
- ***Hot*** **Create/Edit Sewer Structure** - Redesigned as dock-dialog for dynamic sewer editing in active drawing. Shows HGL for current pipe within the editor. Added ability to automatically size pipes and set invert elevations to meet specified design parameters. Added support for box and elliptical pipes. Setup distinct types of structures for circular, box, outfall and junction. Added option to link structure locations to reference a centerline by station-offset and automatically update if the centerline is changed. Also added option to link the rim elevation to the design surface to automatically update if the surface is changed. Added two processing methods of Analyze and Design where Analyze calculates the flows for the current sewer structures and Design calculates the flows and also adjusts pipe size and inverts for tagged structures to meet design parameters. Added more pipe materials including PVC and RCP. Added design parameters for min/max/normal pipe slopes, min/max cover and max pipe length. Added method to insert structure along existing pipe and make connections to that pipe.
- ***New*** **Find and Replace Data Values** -New command to change data values for specific fields in the sewer network.
- ***New*** **Spreadsheet Sewer Editor** - New command for editing sewer network data in a spreadsheet.
- ***New*** **Check Sewer Network Parameters** - New command to audit the sewer network for any invalid data fields or values that don't follow the specified design constraints.
- ***New*** **Check Reference Centerlines and Surface** - New command to check that the sewer network structure locations match their referenced centerline station-offset position and rim elevation offset to design surface.
- ***New*** **Collision Conflicts Check** - New command to report any location conflicts within a specified buffer offset between sewer networks.
- ***New*** **Review Sewer Network/Profile Links** - New command to manage the active sewer links in the drawing.
- ***New*** **HYDRA Processing** - New sewer network processing method to use HYDRA calculation engine from Pizer.
- ***New*** **Sewer Network Hydrographs** - Reports and draws hydrographs for inlets and pipes from the sewer network using the HYDRA calculation engine from Pizer.
- ***New*** **Report Sewer Network** - New report types for inlets, structures, drainage areas and pipes. Added support for report formatter for custom reports. Added report fields of flow depth and inlet spread and depth.
- ***New*** **Move Sewer Label** - New command to move plan view labels and draw a leader to

the structure location.

- *New* **Draw IDF Curve** - New command to draw the IDF curve for the selected storm and return period.
- **Draw Sewer Network Profile** - Added ability to link drawn sewer profile to sewer network so that the drawn profile updates if the sewer network is updated. The structure dimensions for the profile are read from the structure library. Added option to draw sewer lateral connections.
- **Draw Sewer Network Plan View** - Added option to draw pipes as 3D polylines and assign pipe width to use with pipe crossing profiles. Also added option to draw pipes as double parallel lines at the pipe width. Added option to label percent slope and material type along pipes. Added option to draw labels in a table and option to label invert elevations along the pipe. New feature to trim the pipe lines at the structure symbols. Added setting to control text style of the labels. Added separate settings to control the layers for the labels, linework and symbols. Added functions to save and load the plan view settings. Added options for sizing the structure symbol by drawing scaler, unit size or actual size as defined in structure library. Also the dimensions of the outfall headwall symbol are read from the structure library. Added controls for rotating the structure symbol by current twist screen, relative to pipe segment, relative to reference centerline or at a specific angle. Added option to add the bearing quadrant of the pipe direction to the invert elevation labels.
- **Draw Sewer Network 3D Faces** - Added link for the 3D faces to automatically update if the sewer network changes. Also this command will use the structure dimensions as defined in the structure library.
- *New* **Draw Sewer Network Centerline** - New command to create a centerline for the pipe connections between the specified structures.

GIS Commands

- **Report Formatter** - For reports that use polyline perimeters such as Surface Mine Reserves, added ability when outputting the report to a database, to create Carlson GIS links bewteen the polylines and the database. Added more controls for sorting fields.
- *New* **Create Image World File** - New command to create a TFW file from a TIF image.
- *New* **Label Areas With Object Data** - New command that labels object data within Mpolygon areas with smart rules for different methods to handle any label overlaps.
- **Data Capture: Text By Sample, Enclosed Text and Block Attributes** - Rewrote these commands with new user-interfaces and creation of Carlson GIS data links.

Geology Commands

- **Define Strata** - Added function to draw legend of selected strata.
- **Define Drillhole** - Added option to color drillholes by drillhole type. Also added settings for different drillhole symbol sizes by drillhole type.

- ***Hot* Triangulation Modeling** - Added method to apply subdivision to the triangulation to smooth the triangulation surface.
- **Fault Modeling** - Applied method for fault modeling that is used by Inverse Distance to all the other calculation methods including triangulation, kriging and linear least-squares.
- **Channel Samples** - Added double-click editing for channel samples. For modeling with parent-child splits, the channel samples will split along with the drillholes.
- **Strata Isopach Maps** - New option for all layers the same as the main layer. Improved dialog layout.
- **Draw Outcrop** - Added option to draw outcrop as 3D polyline.
- **Fence Diagram** - Added separate settings to control the layers for the profile grid lines, grid labels, surface profile and pit markers.
- **Drillhole Text Formatter** - Added setting for text style for each label field.
- ***New* Geovariances** - New command to import/export drillhole data and grid models with Geovariances Isatis.
- ***New* Mintec Minesight** - New routine to import Mintec Minesight grids in Grid File Utilities.
- **Color Elevation Grid By Strata** - Added setting for max level of grid subdivision.
- ***New* Drillholes Without Key Strata** - New command to locate and report drillholes with no key strata.
- ***New* Import Block Model** - New command to read Q-Pit block models into Carlson format.
- **Draw Block Model** - Added option to limit drawn blocks between top and bottom surface grids.
- **Define Grade Parameters** - Added support for multiple parameter filters assigned to the same grade. Also added support for combining value and discrete parameters in the same block model.
- **Color Elevation Grid By Block Model** - Added options to enter target elevation, to control subdivision level and whether to draw no-grade areas.

Surface Mining Commands

- **Pit Inspector** - Added ability to edit pit data when picking inside pit during inspector.
- ***Hot* Surface Equipment Timing** - Added ability to track key and non-key quantities by strata name for the timing reports.
- **Surface Mine Reserves** - For block model qualities, added report fields for the average qualities within each grade..
- ***New* Reassign Pit Attribute Grid Folders** - New command to set the folder for pit attribute grids for when the data files are moved.

Underground Mining Commands

- **Underground Timing** - Added a problem report in the case that the timing report cannot

continue to explain the reason for the problem. During the detailed timing report, added a progress dialog to show the current position in the mine and the time remaining.

Natural Regrade Commands

- **97 improvements since version 1.0.3.!**
- ***New* Interactive Verification Process** - Added verification on the user-specified slopes and elevations of channels to ensure that all channels, including tributaries, have a concave profile without "knickpoints". Added user assistance with recommendations and one-click fixes for many common design challenges.
- **Channel Inspector** - with added ability to report on 'A'-Channels, watershed area above point.
- **More detailed channel reporting** - with added ability to report on 'A' and 'Aa+' channels- e.g., cross-section reporting, width to depth ratio
- **Surface Selection -** Allows the creation of a TIN file from a selection set.
- **Easier channel selections** - using 'Add" button
- **Easier valley and channel editing -** in 'Preview' mode
- **''Reread valley bottoms'' button** - makes for easier design editing
- ***New* 'Edit Drawing' Mode -** After creating the GeoFluv design surface in the drawing, this new tab on the *Natural Regrade* dockable dialog clearly indicates which commands are to be used to inspect and modify the design surface in the drawing.
- **Calculate volumes** - using inclusion and exclusion polylines
- **Volumes report** - indicate number of inclusion and exclusion polylines used
- **One-button volume updates** - from design surface to comparison surface
- **Shrink / swell settings** - are carried through into cut/fill centroids routine
- **Build .tin 3D surface file** - from entities in the drawing
- **Saves .tin or .flt 3D file format** - for various machine control applications
- **Metric Support** - Further improved localization support by switching automatically to using certain terms such as "chainage" instead of "station" and "Mass Haul" instead of "Cut/Fill Centroid".
- **Corrections for northern and southern hemisphere** slope settings

Takeoff Commands

- **Perimeter Polyline Properties** - Edits the polyline settings for boundary, topsoil and area of interest modes.
- **Update Colors For Set Elevations** - Sets the entities colors for existing and design targets for whether elevations are assigned.
- **Surface Report** - Reports the elevation range and size for each Takeoff surface.
- **Label Subgrade Areas** - Draws labels with the subgrade name and depth for each area.
- **Export Trench Network Data** - Routines to output trench data to points and profiles.

- **Trench Subgrade Areas** - Routines to define areas for different trench templates and backfill.
- **Identify Topsoil Polylines** - Finds polylines with topsoil settings in the drawing.
- **Report Topsoil Areas** - Reports every topsoil removal and replacement area defined in the drawing.
- **Label Topsoil Areas** - Draws labels with the topsoil depth and type.
- **Draw Subgrade Legend** - Draws a legend of the subgrade hatch patterns.
- **Make Overexcavate Surface From Strata** - Sets overexcavate to selected strata surface within perimeter.
- **Existing Surface Vertical Offset** - Adjusts the existing surface vertically within the selected perimeter.
- **Define Materials Library** - Stores material names and costs.
- **Edit-Assign Polyline Elevations** -Added option to show only control points and to label these points in the drawing. Added elevation input by slope and display of slope in different units. Added method to set elevation by selected entity and methods to add points.
- **Edit-Assign Block Materials** - Assigns material names to the different blocks in the drawing.
- **Edit Selected Layer** -Runs the target material and subgrade editor for the selected layer.
- **Highlight Boundary Area** - Highlights the boundary polyline.
- **Identify Area of Interest** - Finds polylines with area of interest settings in the drawing.
- **Report Area of Interest Areas** - Reports every area of interest in the drawing.
- **Hatch Area of Interest Areas** - Hatches each area of interest perimeter in the drawing.
- **Label Area of Interest Areas** - Draws labels with the area of interest name and area.
- **Trench Networks** -Added trench template option for width to be relative to pipe size. Added report options for up to ten zone depths and to report depth zones by station range.

Point Cloud Commands (New module)

- **Load Surfaces** - Imports scan data from various sources.
- **View Surface** - 3D viewer for point cloud data.
- **Scan Utilities** - Routines to resample and filter scan data.
- **Simplify Mesh** - Reduces the size of the model by removing least significant data points.
- **Survey PointCloud** - Creates points and linework within the 3D pointcloud viewer using Field-To-Finish coding.

Data Conversions

- **CARIB97** - Added support for this geoid model.
- **Civil 3D** - New command to convert Civil 3D points into Carlson points.
- **Idan Software** - Added functions to output Idan .DIS linework and .REG point files in Write Polyline File and Export Text/ASCII file. Added method to import Idan .DIS

linework in the Draw Polyline File command.

- **Geopak** - New routine to import Geopak section data from .soe files.
- **Leica GSI** - Added another method of GSI coding for the generic format.
- **Leica 1200** - Added data collector transfer routines for Leica 1200 TS and GPS.
- **Pizer** - New routine to import Pizer cross section files.
- **Topcon Pocket 3D** - In the Draw Polyline File command, added method to import linework from Pocket 3D.
- **Trimble/Geodimeter** - Added command to import section data from .RLN files.

Setting Up a Project

Over 200 program settings can be specified in the Configure command under the Settings menu. These values are used to initialize Carlson program options when opening a new or existing drawing. Among these settings is the coordinate point number format, file and printer output options and settings for each module.

To set the AutoCAD drawing defaults, edit the template drawing (.DWT file). This drawing is loaded when new drawings are created. In the template drawing you can set the layers and AutoCAD variables. For example you could create your standard layers and set variables as you like such as BLIPMODE off. For Carlson, the drawing template should be set to Carlson##.dwt where the ## is the AutoCAD version number. For Carlson running in AutoCAD 2007, the template name is Carlson07.dwt. The Carlson template is located in the Carlson support directory (i.e. C:\Carlson2007\SUP\Carlson07.dwt). To customize the template, run the AutoCAD *OPEN* command and choose the drawing template. In the Select File dialog, set the type of file to Drawing Template (DWT) instead of regular drawings (DWG). Then make your changes and *SAVE* the drawing as Carlson##.dwt.

When starting a new drawing, one of the first steps is to run Drawing Setup under the Settings menu. Drawing Setup sets the drawing scale, the unit mode as either English or metric, and the text, symbol and linetype size scalers. The initial values for these Drawing Setup variables are set in Configure. When a drawing is saved, the Drawing Setup variables are saved with the drawing.

In Carlson, the AutoCAD text style height should be set to zero. The Carlson routines will set the text height according to the drawing scale and text size scaler set in Drawing Setup. For example, if the horizontal scale is set to 50 and the text size scaler is 0.1, Carlson will draw the text with a height of 5 ($50 * 0.1$). Then when the drawing is plotted at 1"=50', the text will be 0.1 inches. Use the AutoCAD *STYLE* command to set the text style height to zero.

The Set Data Directory command in the Settings menu can be used to specify the directory for the project data files. By default the drawing is stored in the Carlson WORK di-

rectory and the data files are stored in the DATA directory. The drawing file is the AutoCAD (.DWG) file. The data files are the coordinate (.CRD) file, profile (.PRO) file, grid (.GRD) file and other Carlson data files. In Configure>Project/Data Folders, there is an option to store all data files in the directory of the drawing. With this option active all the files for the drawing C:\Carlson2007\Work\JOB500\JOB500.dwg would be stored in C:\SCAD2006\WORK\JOB500.

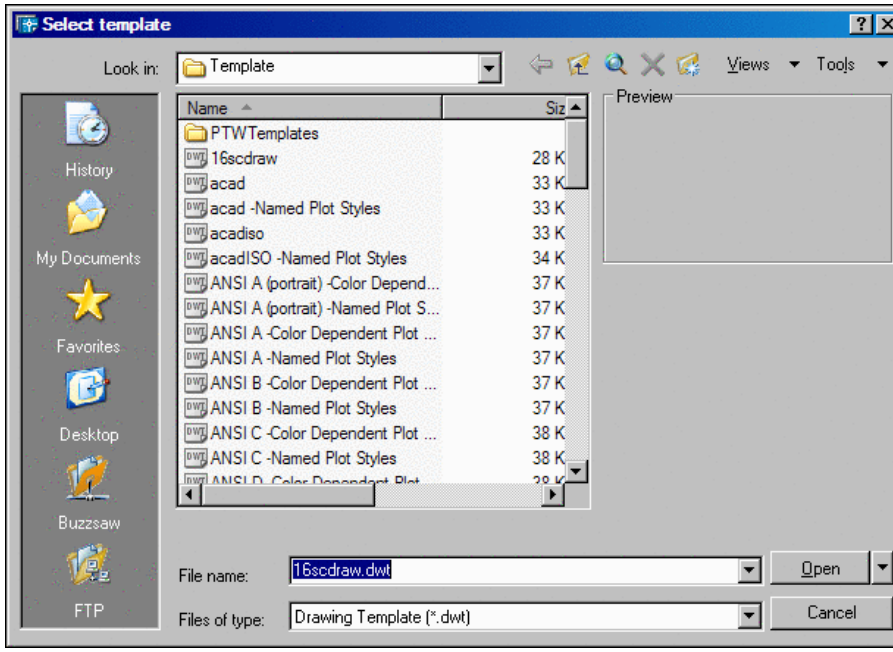
Another level of file management is the automatic project file recall. Every drawing remembers the data files that are being used for the drawing. When the drawing (.DWG) file is saved with the SAVE, SAVEAS, or QSAVE command, Carlson writes a settings file that contains all the active data file names. Then when the drawing is reopened, the data files default to their previous settings. For example, you won't have to choose which coordinate file to use unless you want to change it. The settings file is stored in the same directory as the drawing file and has the same name as the drawing with a .INI extension. For example, a drawing survey.dwg would have a settings file called survey.ini. You can turn off the INI files with the Save Drawing INI Files option in Configure under General Settings.

New/Startup Wizard

The AutoCAD New command is used for starting a new Carlson drawing. This page describe this AutoCAD New command and the Startup Wizard, along with the Carlson variables, associated with it.

Built into this routine is a Startup Wizard that can step you through and make the new Carlson drawing setup process easier. For creating a new drawing in Carlson, the Startup Wizard guides you through starting and setting up the drawing. This wizard is optional, and can be turned on or off in the Configure > General Settings command, which is part of the File pulldown. There is also a dialog box option, shown and mentioned below, that allows you to disable this feature. You can also exit out of the Startup Wizard at any time.

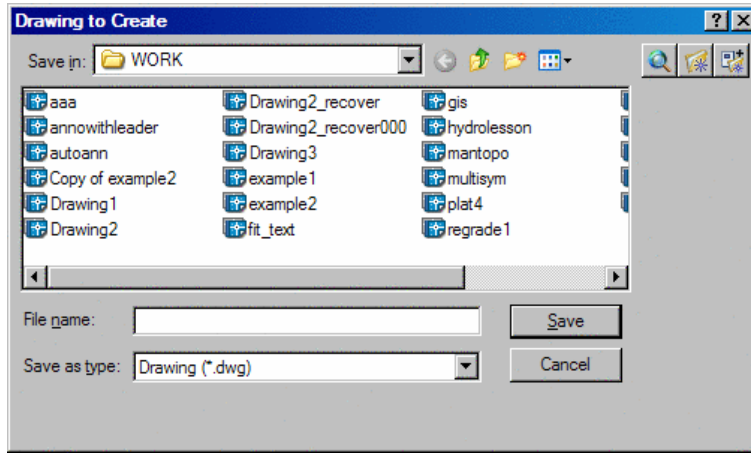
When the AutoCAD *New* drawing command is executed, you first get the standard AutoCAD Select template dialog box. While there are many templates to choose from, and there is an Open option, typically you want to go with choosing the Carlson drawing template (CARLSON07.DWT). The drawing template will set of some basic drawing parameters such as default layer names.



After selecting the template, the Carlson Startup Wizard begins by opening the *New Drawing Wizard* dialog box.

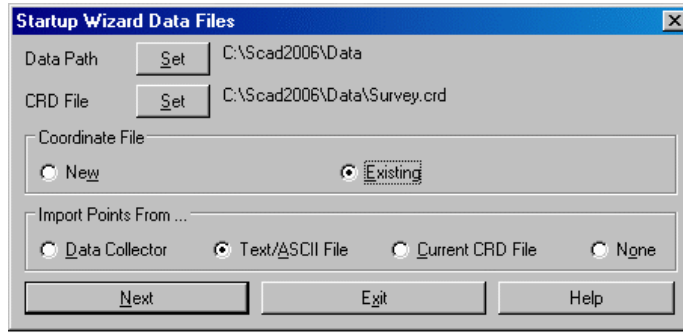
This dialog is used to set the drawing name and scale. The first step to do is set the drawing (.DWG) name by picking the *Set* button. This brings up the file selection dialog. Change to the

directory/folder ("*Save in*" field) where you want to store the drawing. You can either select an existing folder or create a new folder. To select an existing folder, pull down the *Save in* field to select a folder or drive, click the Move Up icon next to the *Save in* field and/or the pick the folder name from the list. To create a new folder, pick the Create New Folder icon to the right of the Save in field. Then type in the drawing name in the *File name* field and click the *Save* button.



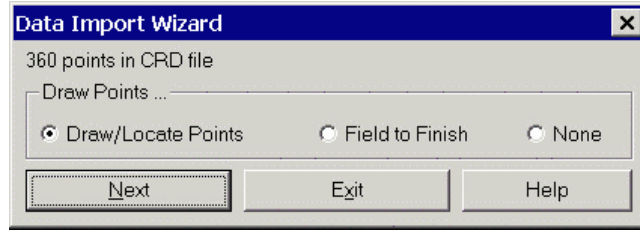
After setting the drawing name, you can set the drawing horizontal scale, symbol size, text size and unit mode (English or Metric). Notice that at the lower left corner of the *New Drawing Wizard* dialog there is an option to Skip Startup Wizard Next Time. Typically, you would leave this option unchecked, as the Wizard is a handy tool for new drawing setup. Now click the Next button.

The next startup dialog sets the Data Path and CRD File. The Data Path is the folder where Carlson will store the data files such as raw (.RW5) files and profile (.PRO) files. The *Set* button for the Data Path allows you to select an existing folder or create a new folder. See the Set Data Directory command for more information. The coordinate (.CRD) File is the coordinate file for storing the point data. There is an option to create a new or existing coordinate (.CRD) file. The new option will erase any point data that is found in the specified CRD file. The existing option will retain any point data in the specified coordinate (.CRD) file. If the specified coordinate (.CRD) file does not exist, the wizard will create a new file.



The next wizard step depends on the Import Points option. The Data Collector option will start the data collection routines to download data from a collector. The Text/ASCII option will import point data from a text/ASCII file. See the Data Collection and Import Text/ASCII File commands for more information on running these routines. The Current CRD File option is a popular one to choose for bringing in coordinates. If the None option is set, then the Startup Wizard is finished.

Once point data has been imported from the data collector, text/ASCII file or CRD file, the wizard guides you through drawing the points. There are options to run Draw/Locate Points, Field To Finish or None. If None is selected, then the Startup Wizard is finished. Draw/Locate Points will import the points into the drawing using the same symbol and layer for all the points. From the Draw/Locate Points dialog, set the symbol, layer and point attributes to draw (description, elevation) and then pick the Draw All button. The Field To Finish command will import the points into the drawing using different layers and symbols depending on the point descriptions that refer to the code table defined in Field to Finish. Also Field to Finish can draw linework. See the Draw/Locate Point and Field To Finish commands for more information on running these routines. After drawing the points, the wizard will zoom the display around the points. Then the wizard is finished.



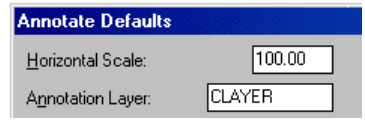
Pulldown Menu Location: File
Keyboard Command: new (AutoCAD)

Prerequisite: None

Layer and Style Defaults

Many Carlson commands have default layers such as AREATXT for area labels and BRGTXT for bearing and distance annotations. These layers can be specified in dialogs for the corresponding commands and several can be set in Configure. Sometimes you may want to use the current layer and it can be an extra step to have to open the dialog to set the layer. In this case, instead of using the default layer that set in the dialog, the default layer can be set as "CLAYER" which will use the current layer. For example, if the annotation layer is set to CLAYER then annotation will be drawn in the current layer instead of BRGTXT or whatever the annotation layer used to be.

This same concept applies for text styles. Several commands have specific text styles and if you want to use the current style instead of the command style, use the name "CSTYLE" for the style name.



Carlson File Types

.AAN Auto-Annotate Settings
.ADF Annotation Default Settings
.ARX AutoCAD Runtime Extension For Carlson Program
.ATR Strata attribute definitions
.AVG Mining Composite Quality Analysis
.BLK Mining Block Model
.CAL Mining equipment calendar
.CAP Capacity file for hydrology (stage-storage)
.CDF Geology Channel Sample File Format
.CDS MDL Laser Raw Data
.CDT Mining custom date table
.CFG Configure Configuration Settings
.CFZ Cut/Fill Color Map Zones
.CGC C&G Coordinate File
.CGR C&G Raw Data
.CH Corehole definition

.CL Centerline file
.CLT Culvert Settings
.CN Hydrology CN Factors
.COG Cadvantage Coordinate Data
.COT Multiple Outlet Design Data
.CQT Mining custom quantity table
.CRB Template Curb Definition
.CRD Coordinate file (point#, northing, easting, elevation, description) in binary form
.CTL SDMS Format Raw Data
.CTR Auto-Run Strata Isopach Maps
.CUI Customized User Interface AutoCAD Menu
.CUT SMI Format Cutsheet
.CVT SEDCAD Format Hydro Network
.DAT GPS Localization Definition
.DCF Deed Correlation File
.DCL Carlson dialogs
.DEM Digital Elevation Model
.DEQ Drillhole equations
.DHF Drillhole Text File
.DHT Dragline History
.DIL StrataCalc Convert As-Determined Qualities
.DLL Carlson programs files
.DTF Drillhole Data Format
.DTS Drillhole Text Settings
.DWG AutoCAD drawings
.DXF Drawing Exchange Format
.DZR Dozer Push Settings
.EQO Mining equipment options
.EQU Mining equipment definitions
.ERD Erodible Channel Settings
.EW Earthwork Section End Areas
.EXE Carlson programs
.FCL Feature Code List for SurvCE
.FEN Fence Diagram Settings
.FLD Field to Finish code definitions
.FLT Triangulation mesh
.FMS Report Formatter Settings
.FRM Ferm Codes
.GCL Geologic Column Settings

.GEO Settings for Draw Geologic
.GFU Grid File Utilities macro command recorder file
.GIS GIS prompting definitions for note files
.GPF Grade Parameter File For Block Model
.GRD Grid file - a DTM surface model
.GSQ Grid sequence history file for mining
.H1 Hydrograph
.H2I HEC-2 Water Surface Profile
.HYD Watershed settings
.HZN Horizon code definitions
.IMP Drillhole Import Format
.INI Program user preferences settings
.LAY Layer State
.LEV Level Raw Data
.LGD Annotate Draw Legend definition file
.LOT Lot file for Survey
.LPT Coordinate Transformation Point File
.LQE Least-Squares Measurement Error Settings
.LSP Carlson Lisp programs
.LSQ Least-squares input data
.LSS Localization Settings
.LTD Lot Attribute Definition
.MAT Materials Library
.MDN Template Median Definition
.MIN Underground Mining Report
.MNC Compiled menus
.MNL Carlson Lisp programs for corresponding menu startup
.MNR Compiled menus
.MNS Compiled menus
.MNU Carlson source menus
.MNX Compiled menus
.MPD Mining Timing Project File
.MPJ Mining project definitions
.MXS Cross section alignment
.NOT Note file - additional descriptions for points in corresponding .CRD file
.OWN Mining Ownership Data
.PAN Mining Underground Panel Data
.PAR Parameters for mining quality compliance
.PAT Hatch Pattern Definitions

.PDD Enter Deed Description data file
.PFF Mining Pit Format File
.PFS Draw Profile Settings
.PHN Modem Settings For Carlson Field
.PIT Mining Pit Parameter File
.PLN Plan view polyline file for Dozer 2000
.PNA Mining panel attributes
.PPQ Polygon Processor Query
.PRE Pre-calculated grids for strata model
.PRF Point Range File
.PRJ Project settings file
.PRO Profile (station, elevation, descriptions)
.PSZ Pipe Size Definitions
.PTA Mining pit attributes
.PVF System Variable Settings
.PVL Sewer Network Plan View Label Settings
.PVS Mining Projection and Ventilation Settings
.RCF Drainage Runoff Library
.RCL Runoff Coefficient Layer Definitions
.RDF Road Design File
.RDN Road Network File
.RDS Roadside Ditch File
.REC Seismic Record Output
.REP Hec-Ras Report File
.RES Mining Auto-Run Residuals Settings
.RME Reame Slope Stability Settings
.RMP RiverMorph Project
.RPT Report Formatter Data
.RSV Mining Reserve Description
.RUN Auto-Run Strata Grids definition file
.RW5 Raw file of traverse data
.SC Coal Section Configuration
.SC5 SurvCE Raw Data Archive
.SCR COGO script file
.SCT Cross section data (station, offset, elevation, descriptions)
.SDF Strata Definitions
.SDT SB-Slope Stability File
.SEQ Dragline sequence file
.SEW Sewer network file for hydrology

.SGD Slope Group Definition for Design Pad Template
.SIF Surface Inspector File
.SLB Slide library
.SLD Slide image
.SLI Symbol Library
.SST Draw Section Sheet Settings
.STG Stage-discharge data for hydrology
.STR Sewer Structure Library
.SUP Superelevation file
.TAB Hydrology Peak Flow Data
.TCF Digitizer Tablet Configuration File
.TCH Trench Structure Template
.TIM Mining Timing Settings
.TIN Triangulation Surface
.TKD Takeoff Material Definitions
.TOP Topsoil Definition for Road Design
.TPC Template point centerline definition
.TPL Template file for Section-Profile
.TPP Template point profile definition
.TPT Template transition file for Civil Design
.TRG Takeoff Layer Target Settings
.TSF Road Template Series File
.UAO Report Formatter Attribute Options
.UAT Report Formatter User Attributes
.UDP User-Defined Projection For Grid Coordinates
.VOL Auto-Run Strata Quantities definition file
.WST Watershed Structure File
.XML LandXML Data Exchange File
.ZIP Compressed Data Files
.ZON Earthwork Zone Definitions

Standard Report Viewer

Many Carlson routines display output in the Standard Report Viewer as shown below. The report can be edited directly in the report viewer. Report Viewer commands are described below.

Open: This allows you to open an ASCII file and display the contents in the report viewer.

Save: Save the contents of the report viewer to a text file.

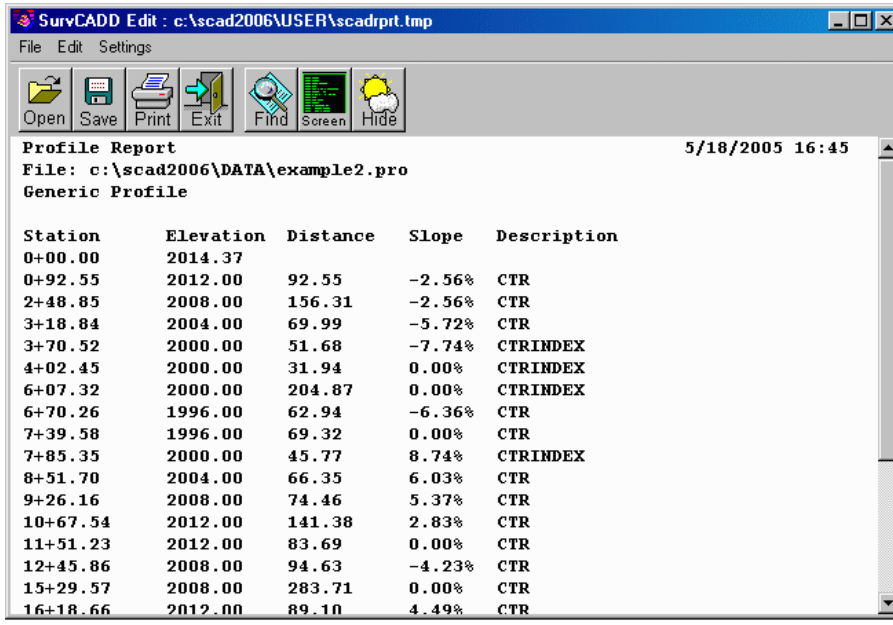
SaveAs: This allows you to save the contents of the report viewer to a file.

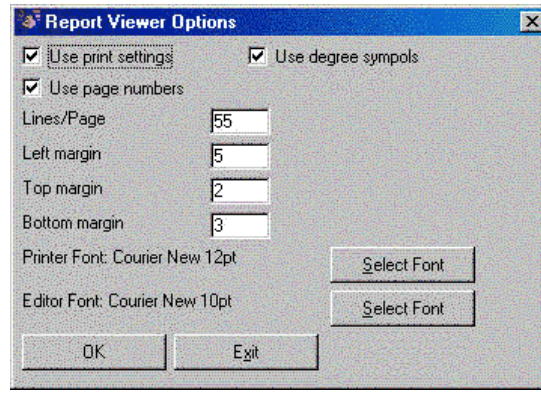
Append To: This allows you to append the contents of the report viewer to another file.

Print: Print the contents of the report viewer. This will open the standard windows Print dialog where you can choose the printer and modify any of the printer settings before you actually print.

Screen: Draws the report in the current drawing. The program will prompt you for a starting point, text height, rotation, layer and whether you want it inserted as Mtext or Text.

Undo: Reverses the effect of your last action. If you mistakenly deleted some text, stop and choose the Undo command to restore it. The key combination Ctrl+Z also performs this action.





Select All: Selects all the text in the report viewer.

Cut: Deletes the selected text and places it on the Windows® clipboard.

Copy: Copies the selected text to the Windows® clipboard.

Paste: Inserts ASCII text from the Windows® Clipboard into the report viewer at the cursor.

Search: Opens the Find Text dialog. Allows you to search for text in the report viewer.

Replace: Opens the Find and Replace Text dialog. Allows you to search for text and replace it.

Options: Opens the Report Viewer Options dialog. In this dialog, you can specify print settings, such as lines per page and margins. You can also specify the font used in the report viewer. This font is used for both the display and for printing.

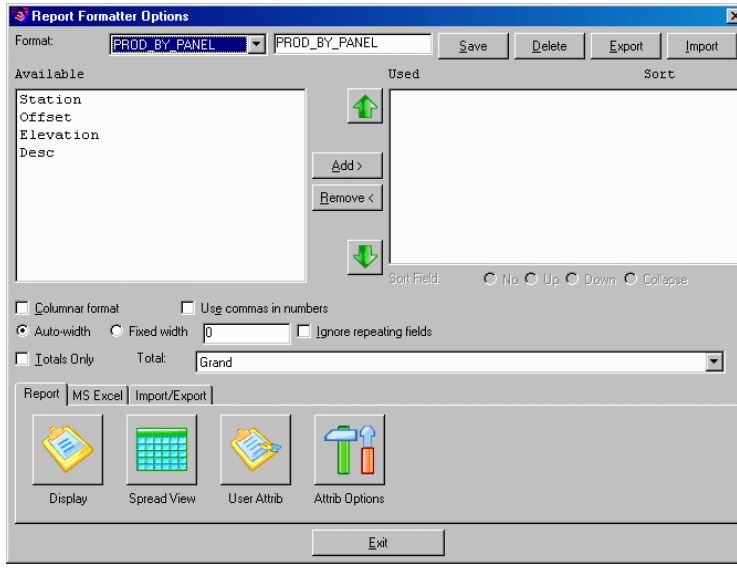
Hide: This button allows you to minimize the report viewer window and give focus back to AutoCAD. This allows you to return to working in AutoCAD without closing the report. You can re-activate the report by picking on the minimized report viewer icon.

Report Formatter Dialog

A number of Carlson routines use a dialog box called Report Formatter Options to allow you to specify how and which results of calculations should be presented in the report. This report routine lets you select a set of data to report and the format of the selected data. The report can be displayed in either the standard report viewer as described in the previous section, Microsoft® Excel or Microsoft® Access.

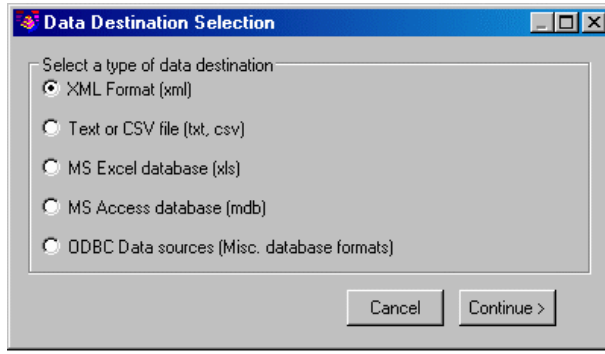
The data set in the Report Formatter may be thought of as a spreadsheet, where columns are various fields related to a single item such as time period, drillhole, area and etc. Each new row

represents a new item. Descriptions of these field names are displayed in the Available list of the Report Formatter. To include a data field in the report, highlight the field name in the Available list on the left and pick the Add button. This moves the field name to the Used list on the right. The order of items in the right list defines the order in which they will be displayed. In addition, the items may be sorted as specified by the user in the right column. Items are first sorted by the first column, then items with the same value in the first column are sorted as specified for the second column, and so on.



These subsequent sortings do not modify sortings of previous columns. If you specify no sorting for some column (even the first one) then no sorting will happen in subsequent columns either. For example, you may want to sort production by mining panel name but not by month.

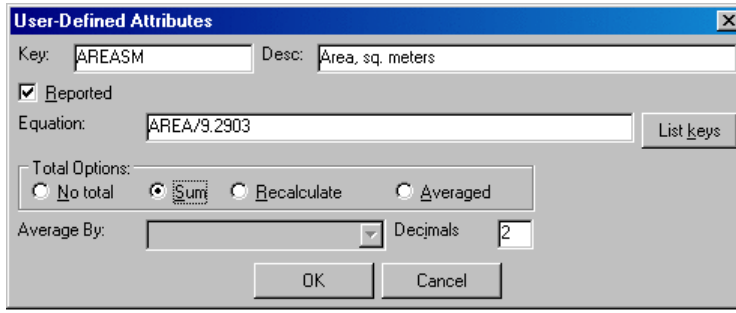
To generate the report after selecting columns and other preferences, click on Display button. It will bring up a standard report viewer showing the report data. Upon exiting the viewer, you come back into the Report Formatter for further data manipulation if needed. The other data output and destination options include saving the specified data into a comma-delimited text or CSV file, creating a spreadsheet preview whereby the data may be exported using several methods, and direct export to Microsoft® Excel. Due to the popularity of the Excel output choice, you can also customize certain Excel options, including setting mirror output, just prior to export. Data can also be merged to combine current and old reports, and it be exported to XML format files. There is an option for output to other database formats as well.

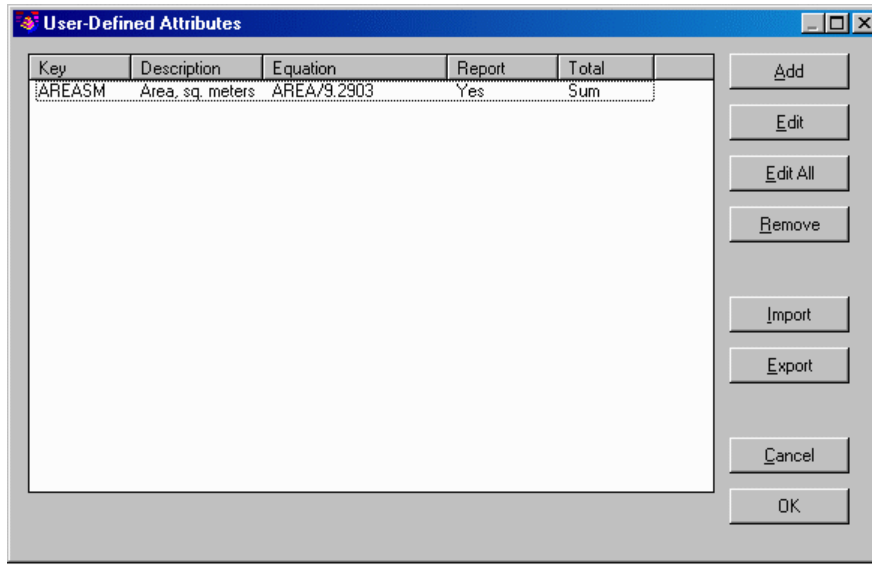


You may define new columns as equations based on existing columns. Click on the Edit User Attributes button to add a new field name. A list of the existing attributes is available for reference.

User attributes may have one of the several summation options just like program-generated ones (except that for them these options are set by program). The summation level is defined by the "Total" pop-up list in the middle of the dialog. By default only grand total will be displayed at the bottom of the list. By picking the next item in that box, you will get subtotals added each time the value in first column is changed. It makes most sense to use this kind to summation if the corresponding column is sorted. For example if the first column is "Area Name" and it is sorted, and "Total" is set to "Grand, Area Name" the report will have a sub-total for each distinct Area Name. This feature makes the Report Formatter a very flexible tool for results exploration, even before or without using a spreadsheet.

Various forms of reports may be saved and recalled using controls in the top line of the dialog.

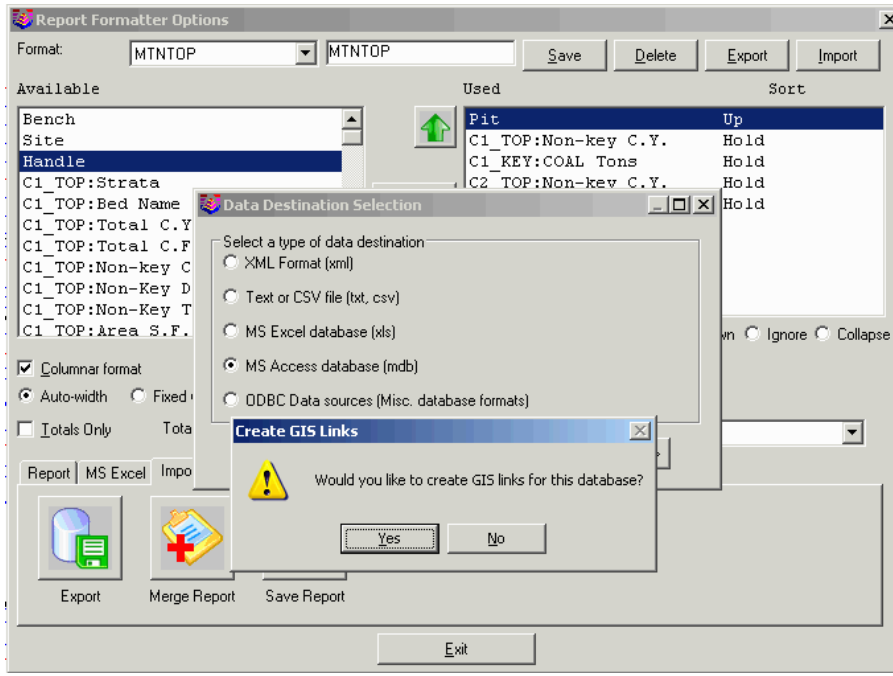




To save a new version of the format, type in a new name (or use default to overwrite old one) and click on the Save button. The next time that you come to the Report Formatter from the same Carlson routine it will recall this last format. To pick another format just pull down on list of formats in the left top corner and pick which format to use. To Delete an unwanted format, pick it from the list first and then click on Delete button.

There are several Microsoft® Excel export options provided. You may specify a spreadsheet file to load before export, as well as a left upper cell to start with and sheet number to use. Totals which are reported when using built-in viewer may be skipped when using Microsoft® Excel export.

For commands that process reports using perimeter polylines, the Report Formatter has an option to create GIS links between the polylines and the database records when the Export to MS Access function is used. Some commands that apply are Surface Mine Reserves with the pit polylines and Underground Timing with the panel polylines. When the polyline data is available for the GIS Links, there will be a report field called Handle. This Handle field is the AutoCAD entity name for the polyline and serves as the hook for the GIS link. The Handle field does not need to be put into the report Used list in order to create the links. When the Export function is called with the MS Access method, there is a pop-up window prompt for whether to create the GIS links. When these links are created, you can then use the GIS Data commands from the GIS module to manage and report the data.



Instruction Manual and Program Conventions

Westwood
Italic text represent responses by the user that should be typed in and followed by the Enter key.

Number/<Pick point>:
Bold text represents prompts or questions that the computer program will ask the user.

<90.0000>
Values enclosed in corner brackets represent default values obtained by pressing Enter with a blank response to AutoCAD or Carlson commands.

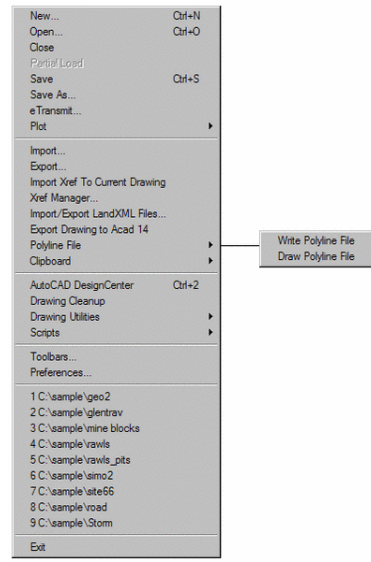
[end on]
Lower case text enclosed in brackets in Command prompts denotes an *OSNAP* mode that is turned on by the command.

General Commands

File Menu

All the Carlson module menus share six of the same pull-down menus which are File, Edit, View, Draw, Inquiry, Settings and Points. Within a module, only the other pull-down menus, typically three or four, are specific to the module. The common pull-down menus contain general commands that are applicable within all the modules. Many of these commands are AutoCAD commands which are described in your AutoCAD Reference manual. The Carlson commands located in the common pull-down menus are explained in the next sections.

All the options on the File menu not described here are AutoCAD commands which are discussed in the AutoCAD Reference Manual. The set of AutoCAD commands varies slightly between the AutoCAD versions.



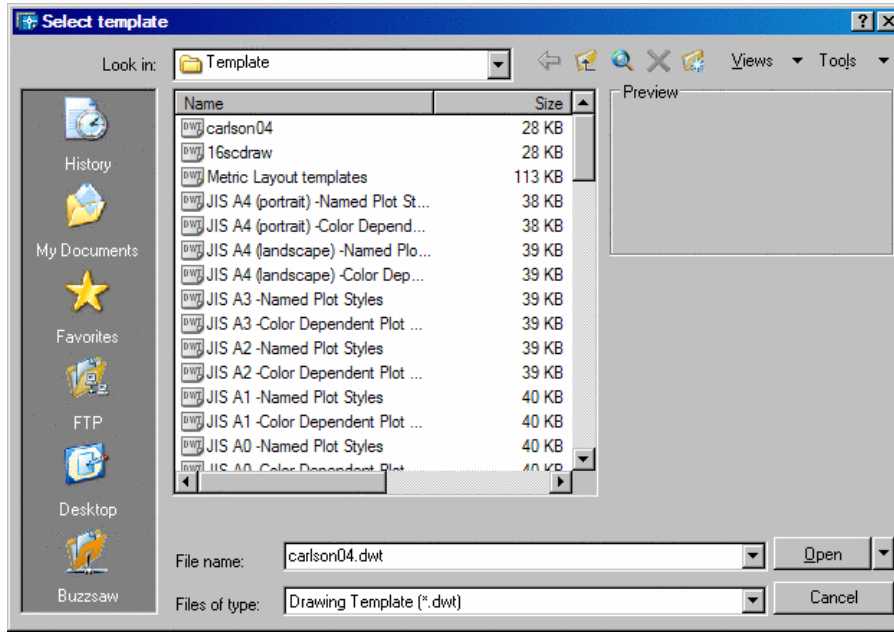
New

Function

This command allows you to create a new drawing file. This routine defines the settings for a new drawing. You can start a new drawing file by selecting New, and then picking a template file. The first dialog for the New command, called Select Template, lists all template files that currently exist in the drawing template file location. Choose a file to use as a starting point for your new

drawing. A preview image of the selected file is displayed to the right.

The template file (.DWT) that you use will depend on the version of AutoCAD that you are running. For AutoCAD 2000-2002, the Carlson templat file is carlson02.dwt. For AutoCAD 2004, it is carlson04.dwt. For AutoCAD 2005, it is carlson05.dwt. For AutoCAD 2006, it is carlson06.dwt. And for AutoCAD 2007, the Carlson template file is carlson07.dwt. After choosing the template, click the Open button at the lower-right. Next, you will either see the New Drawing Wizard dialog box, or you will be taken to a blank screen. Should you use the wizard, a new drawing name will need to be chosen in order to get to the next step.



If the wizard is in use, the following options will be available to you in the New Drawing Wizard dialog. The New command starts a new drawing using default settings defined in one of the carlson .DWT template files, depending on the measurement system you've chosen. You cannot modify the surv.dwt or surviso.dwt templates. To start a new drawing based on a customized template, see Use a Template.

English: This option starts a new drawing based on the Imperial measurement system. The drawing is based on the surv.dwt template, and the default drawing boundary (the drawing limits) is 12 × 9 inches.
Metric: This option starts a new drawing based on the metric measurement system. The drawing is based on the surviso.dwt template, and the default drawing boundary (the drawing limits) is 429 × 297 millimeters.

The New command creates a new drawing, using the settings defined in a template drawing you select. Template drawings store all the settings for a drawing and may also include predefined layers, dimension styles, and views. Template drawings are distinguished from other drawing files by the .DWT file extension. They are normally kept in the template directory. Several template drawings are included with Carlson. You can make additional template drawings by changing the extensions of drawing file names to .DWT.

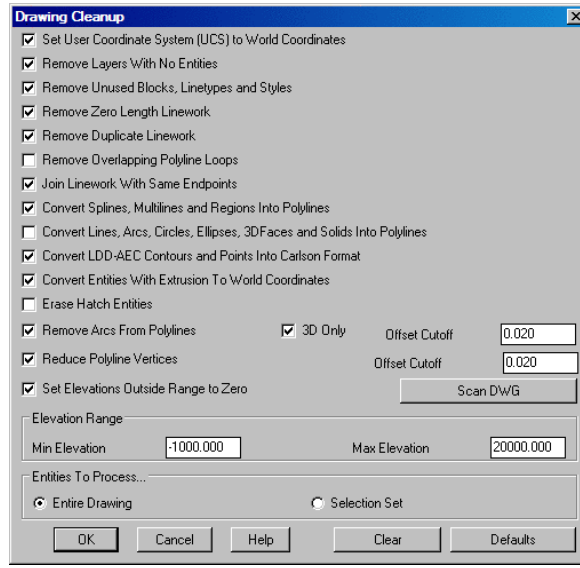
Remember that there are two methods that you can use to work on a Carlson drawing. One is the New command, and the other is the more generic Open command. If you need to open an existing drawing, use Open, also found in the File menu, and then choose an existing file name.

Pulldown Menu Location: File
Keyboard Command: new
Prerequisite: None

Drawing Cleanup

Function

The Drawing Cleanup dialog box allows you to perform many functions that fix common errors, and it removes unnecessary data found in many drawing files. It also converts incompatible data into useful entities. This command offers many filters that audit the drawing file and allows you to select which options and settings you want to use. A report of the cleanup results will be displayed upon completion. Always save your file when the drawing cleanup routine is complete.



Set UCS to World Coordinates

This sets the UCS (user coordinate system) to the world coordinate system (WCS). Carlson works exclusively in the world coordinate system and there is no way to change this setting. In AutoCAD, it is possible to change the coordinate system from WCS. If you receive a drawing in which the coordinate system is not set to world, click this on to restore the UCS.

Remove Layers With No Entities

AutoCAD drawings work with a "BYLAYER" concept meaning that layer definitions define the drawing. For example, the layer named EOP might be used to display polylines at the Edge Of Pavement in the drawing. Many times extra layers get defined by a user but not used to display any objects. This function removes any layers defined in the drawing that are not being used.

Remove Unused Blocks, Linetypes and Styles

This functions removes this unused information from the drawing.

Remove Zero Length Linework
This function seeks out and removes any linework definition that have zero length. Point nodes are not removed.

Remove Duplicate Linework
This function finds any duplicate linework in the drawing and removes all but one set.

Remove Overlapping Polyline Loops
Polylines that completely overlap themselves are broken into two different polylines.

Join Linework With Same Endpoint
This function finds common endpoints on linework on common layers with common elevations and joins the linework into a continuous polylines. This is very helpful for future selection sets.

Convert Splines, Multilines and Regions Into Polylines
Some CAD applications utilize Spline Object Definitions and Regions, Carlson utilizes basic polyline/polygon definitions. This function finds any Splines and/or Regions defined in the drawing and re-defines them as simple polylines or polygons.

Convert Lines, Arcs, Circles, Ellipses, 3DFaces and Solids Into Polylines
By converting Lines, Arcs, Circles, Ellipses, 3D Faces, and Solids into Polylines, you can use the variety of Polyline commands available in Carlson.

Convert LDD-AEC Contours and Points Into Carlson Format
Drawings created in the Land Development Desktop CAD program can contain special objects known as LDD-AEC contours that define their topographic contour display. This function locates those special objects and re-defines them as simple 2D polylines retaining their elevation values.

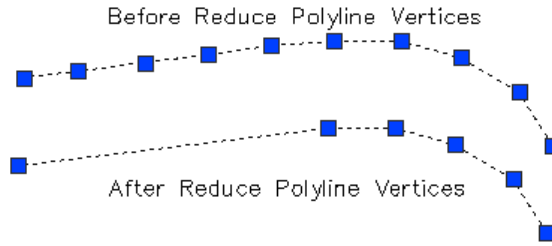
Convert Entities With Extrusion To World Coordinates
Drawings created in the Land Development Desktop CAD program can contain special objects known as LDD-AEC contours that define their topographic contour display. This function locates those special objects and re-defines them as simple 2D polylines retaining their elevation values.

Erase Hatch Entities
Carlson offers many hatch display options, however hatch entities have no 3D value. This function removes all hatch entities in the original drawing to help reduce the size and clutter of the drawing file.

Remove Arcs From Polylines - Offset Cutoff
This function replaces arcs in polylines with a series of short chord segments. The purpose is to prepare the polylines for modeling since arcs need to be converted into segments to be part of

the triangulation model. The density of of chord segments is controlled by the offset cutoff. This cutoff represents how much the polyline can move horizontally. A smaller cutoff will result in more chord segments. The option for 3D Only controls whether only polylines at zero elevation or both zero and elevated polylines get processed. Sometimes you may want to leave the arcs in zero elevation polylines when these polylines represent road alignments and are not part of the surface model.

Reduce Polyline Vertices - Offset Cutoff
This function utilizes a pre determined offset amount and removes unnecessary polyline vertices that fall within the offset amount.



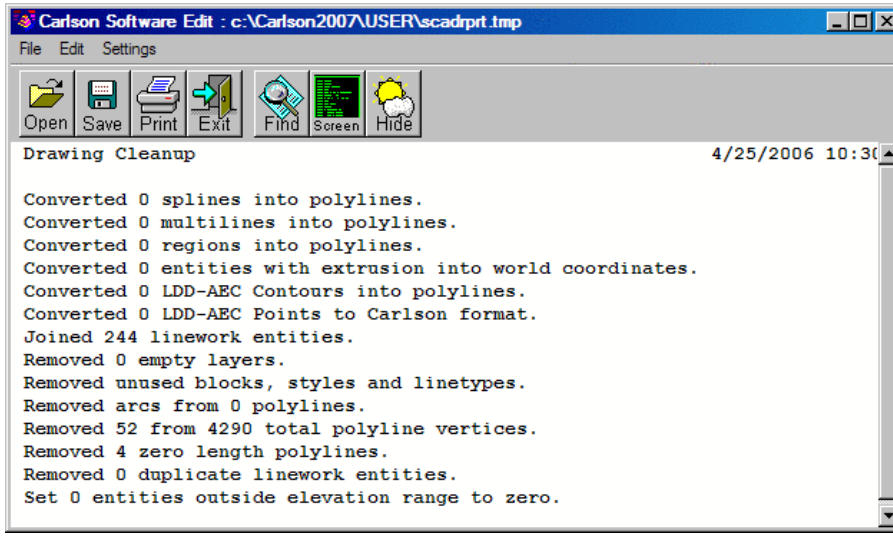
Set Elevations Outside Range to Zero and Elevation Range
This function comes with a "Scan DWG" option that audits the elevation range in the drawing file. Once the minimum and maximum elevation range has been set, manually or by a scan, all objects that fall outside the set range are moved to elevation zero. All objects at zero elevation do not contribute to the 3D model.

Entities To Process...
This allows you to run the command for the entire drawing or for a selected set.

Default
This allows you to return to the Carlson Drawing Cleanup default settings.

Final Report
This example report displays the results of drawing cleanup. Like all reports in Carlson, this report can be saved to a text file, sent directly to your printer, or pasted onto the screen ad text

entities.


Carlson Software Edit : c:\Carlson2007\USER\scadrprt.tmp
File Edit Settings
Open Save Print Exit Find Screen Hide
Drawing Cleanup 4/25/2006 10:3
Converted 0 splines into polylines.
Converted 0 multilines into polylines.
Converted 0 regions into polylines.
Converted 0 entities with extrusion into world coordinates.
Converted 0 LDD-AEC Contours into polylines.
Converted 0 LDD-AEC Points to Carlson format.
Joined 244 linework entities.
Removed 0 empty layers.
Removed unused blocks, styles and linetypes.
Removed arcs from 0 polylines.
Removed 52 from 4290 total polyline vertices.
Removed 4 zero length polylines.
Removed 0 duplicate linework entities.
Set 0 entities outside elevation range to zero.

Pulldown Menu Location: File
Keyboard Command: dwg_cleanup
Prerequisite: None
File Name: \lsp\poly3d.arx

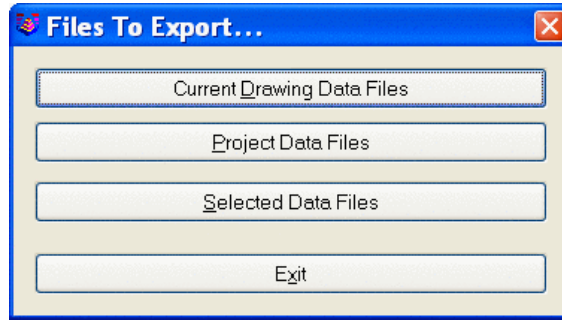
Import/Export LandXML Files

Function

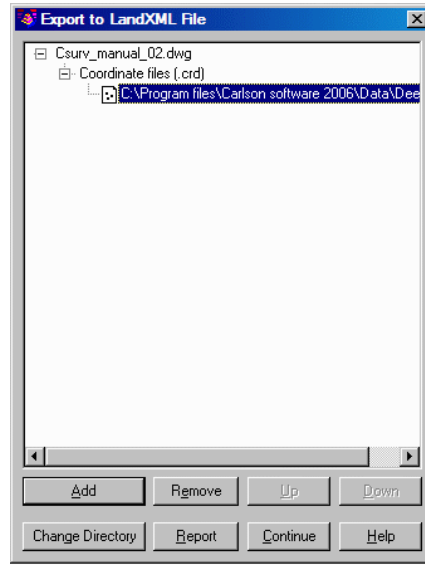
This command performs two functions: Export Carlson files to LandXML and Import LandXML files into Carlson. This command supports version 1.0 of LandXML and the following Carlson file types: Coordinate (.CRD) files, Centerline (.CL) files, Profile (.PRO) files, Section (.SCT) files, Grid (.GRD) files, Triangulation (.FLT) files, and Lot (.LOT) files.

Export to LandXML: Allows you to export a Carlson file to LandXML. Choose a new or existing LandXML file, then choose an existing Carlson file.
Import to Carlson: Allows you to import a LandXML file into Carlson. First, choose a new or existing Carlson file, then choose an existing LandXML file.

You first see the Import/Export LandXML dialog. To Export, for example, first click Export to LandXML. Then click Current Drawing Data Files button. You will then see the Select LandXML File dialog box. Select an existing .XML file to be exported from the list of files on the right and click Open.



The next dialog appears, showing the new buttons to be used for the Export. Choose the Add, Remove, Change Directory and/or Report buttons, and then Continue.



Choosing the Continue button takes you further into the Export process. The Report button will give you the Report Formatter Options dialog box.

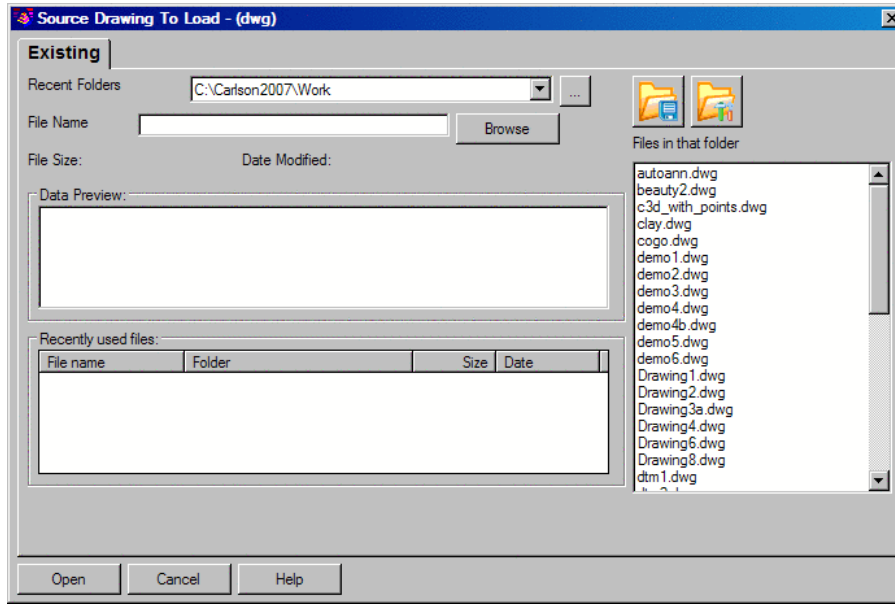
Data protection is turned on by default, meaning that if you are importing/exporting to an existing file, you will be prompted before the program overwrites existing data. There is a Point Protection option that will not allow any points to be overwritten if the same number appears more than once in the XML file being imported. If you decide to Import From LandXML, go back to the opening dialog an choose the existing LandXML file.

Pulldown Menu Location: File
Keyboard Command: imp_exp
Prerequisite: Files to convert
File Name: \lsp\gisutil.arx

Export Drawing to AutoCAD 14

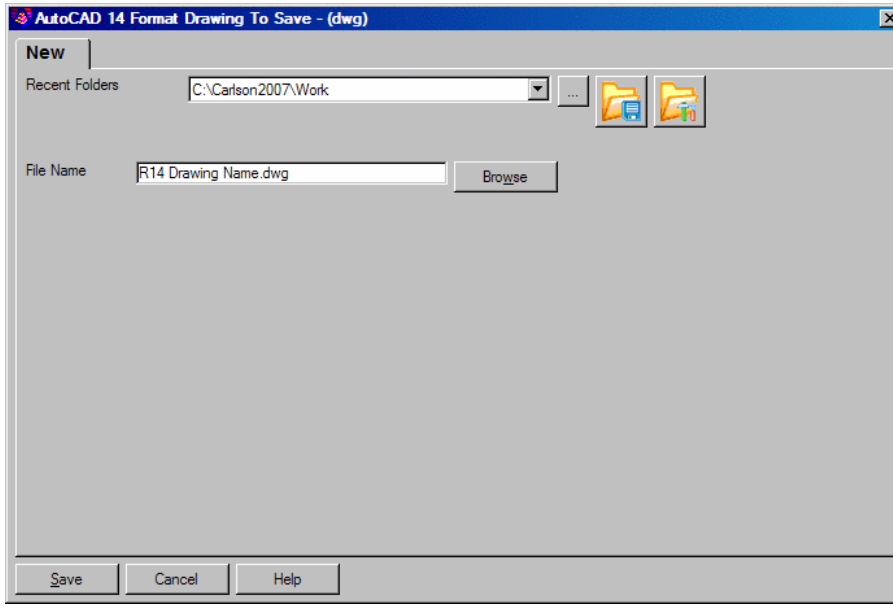
Function

This command will save an existing Carlson drawing to AutoCAD R14 format. This command is for Carlson in AutoCAD 2004 and Carlson working in AutoCAD 2005.



Prompts

Source Drawing To Load dialog *select a .DWG file*
AutoCAD R14 Format Drawing To Save dialog *select name for a new .DWG file*
Files saves to R14.



Pulldown Menu Location: File
Keyboard Command: dwg2r14
Prerequisite: An existing Carlson .DWG file, using Carlson in AutoCAD 2004 or Carlson in AutoCAD 2005
File Name: \lsp\gisutil.arx

Write Polyline File

Function

This command creates a polyline file that contains the point data of the select polylines. The objects supported by this tool include polylines, arcs and lines. If you want to include text, you must use the *Text Explode To Polylines* command found in the Edit menu to convert the text to polylines before running this command. This polyline file is a text file that has three formats. The Carlson format (.PLN) is used by some Carlson commands and by machine control (Carlson Grade, Dozer 2000, GradeStar) for the plan view. Each polyline begins with a line of "POLYLINE, Color number". Then the points for the polyline are listed on separate lines in X,Y,Z format. Here is a list of the available color numbers:

0 = Black
1 = Blue
2 = Green
3 = Cyan
4 = Red
5 = Magenta
6 = Brown
7 = Light Gray
8 = Dark Gray
9 = Light Blue
10 = Light Green
11 = Light Cyan
12 = Light Red
13 = Light Magenta
14 = Yellow
15 = White

The MicroStation format (.txt) can be imported into MicroStation. This format has the coordinates as space delimited for each polyline point. There is an extra column with a 1 or 0 where 1 specifies the start of a new polyline. The DTM and Idan formats create linework files for the DTM and Idan programs.

Prompts

Polyline file format [<Carlson>/DTM/Idan/MicroStation]? *press Enter for Carlson format*
Specify File to Write dialog *create a new file or append to existing*
Polyline file for Grid File Utilities macro [Yes/<No>]? *press Enter* The option will write a polyline file that can be used with Grid File Utilities for inclusion/exclusion perimeters.
Include Z coordinate in polyline file [Yes/<No>]? *press Enter* This option controls whether the polyline vertices are written in 2D or 3D.
Specify Exclusion/Warning Polylines [Yes/<No>]? *press Enter* This option applies to machine control for warning areas.
Specify WorkZone Polylines [Yes/<No>]? *press Enter* This option applies to machine control for working areas.
Reduce Polyline Vertices [<Yes>/No]? *press Enter* This option applies Reduce Polyline to the polyline vertices before writing the file.
Enter reduce offset cutoff <0.1>: *press Enter*
Decimal places for coordinates <2>: *press Enter*
Select polylines, lines and arcs to write.
Select objects: *pick the entities to process*
Done.

Sample Polyline File:

POLYLINE,15

47639.82,74540.11,0.00
47670.49,74565.79,0.00
47701.08,74591.49,0.00
49375.61,76358.47,0.00
50066.86,76846.75,0.00
POLYLINE,15
47633.24,74547.97,0.00
47663.90,74573.65,0.00
etc...

Pulldown Menu Location: File->Polyline File
Keyboard Command: polywrite
Prerequisite: Polylines in the drawing
File Name: \lsp\scadutil.arx

Draw Polyline File

Function

This command draws polylines from the selected polyline file. These polylines are drawn in the current layer. This command supports the following formats: Carlson (.PLN), Idan (.DIS), MicroStation (.TXT), MOSS (.INP, .PRN) and Topcon Pocket 3D (.TXT).

Prompts

Polyline file format [<Carlson>/DTM/Idan/MicroStation/MOSS/Topcon]? *press Enter to accept Carlson*
Polyline File to Read Dialog *select existing .PLN file*

Pulldown Menu Location: File->Polyline File
Keyboard Command: polydraw
Prerequisite: A polyline file
File Name: \lsp\scadutil.arx

Remove Reactors

Function

This command removes the reactor links from the selected points, text, polylines and lines. This disables the links for points to the coordinate (.CRD) file, annotation with linework and

linework with points. Note that is *General Settings* there is a section called Object Linking. This is the specific section that contains the options for creating these reactors to the drawing entities. Reactors can be turned off for entities created later by clicking off the four link options in *General Settings.* To get to this dialog go to *Settings* > *Configure* > *General Settings*.

Prompts

Select entities to remove reactors from:
Select objects: *pick the entities*

Pulldown Menu Location: File > Drawing Utilities
Keyboard Command: delreact
Prerequisite: Entities with reactors
File Name: \lsp\crdutil.arx

Remove Groups

Function

This command is used to "ungroup" selected entities that, prior to using this command, were part of an AutoCAD group. For our purposes, we might more specifically be referring to Carlson's Point Entity Grouping feature. A group is a named selection set of objects. This routine removes selected entities from groups. It is especially useful when dealing with our Carlson points.

More on Point Entity Grouping: As mentioned in the Points chapter, remember that for each point, the point attribute block, node, and symbol can be bound together. This means that if you choose to use the *Move* command (or other AutoCAD tools) the entire collection moves together. This is done using the grouping functionality in AutoCAD. To disable this system altogether, go to *Configure*, choose *General Settings*, and turn off the toggle for Group Point Entities. If you need to temporarily disable grouping in a drawing, you can use the AutoCAD toggle for grouping, which is Ctrl-A. Holding down the Ctrl key, and pressing the letter A on the keyboard, activates this two-way toggle, with the current status echoed to the command prompt area.

Prompts

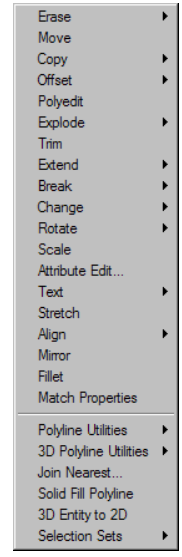
Select entities to remove from groups.
Select objects: select entities

Pulldown Menu Location: File > Drawing Utilities

Keyboard Command: rmgroup
Prerequisite: Entities in group(s)
File Name: \lsp\poly3d.arx

Edit Menu

In addition to AutoCAD's powerful editing commands, the Carlson Edit menu has the additional commands which are explained in this section. Commands that are pure AutoCAD are not detailed here. They can be found in the AutoCAD manual.

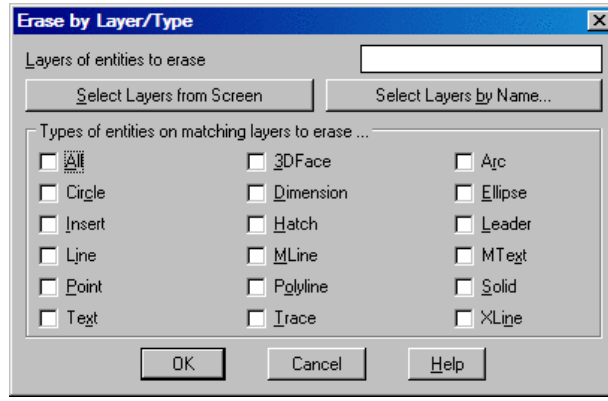


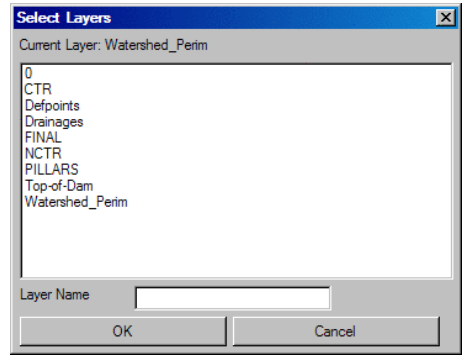
Erase by Layer

Function

This command will ERASE all the entities on the specified layers but will not delete these layers from the drawing. The command prompts for the layer name to erase and then erases all entities

on that layer. In addition to typing in the layer name, you can also specify a layer to delete by picking an entity on that layer. To select layers by picking, first click the **Select Layers from Screen** button and then select the entities on the layers to be deleted. The **Select Layers by Name** button allows you to choose a layer name from a list of layers in the drawing. You can also specify which types of entities to erase. For instance, if you have both linework and points on the same layer and you want to erase only the linework, you can click off All and check Line and Polyline.





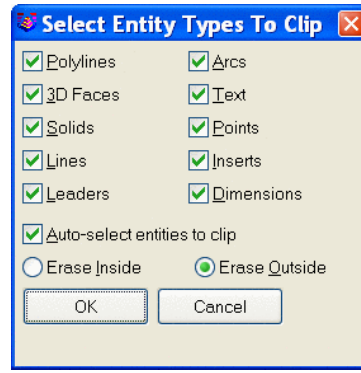
Pulldown Menu Location: Edit > Erase
Keyboard Command: ldel
Prerequisite: Something to erase
File Name: \lsp\dellayr.lsp

Erase by Closed Polyline

Function

This tool is used to clean up drawing geometry at the extents of a polyline boundary. It provides options to erase adjacent geometry as well as trim geometry crossing the fence of the polyline.

First, select the boundary polyline. Only one can be selected. Designate the desired options in the following dialog. The top section of the dialog allows you to toggle which object types should be affected by the operation. Note that some of the objects, such as text and inserts, cannot be trimmed.



In the middle of the dialog is a toggle that determines whether to prompt for objects to process. If you want to isolate the drawings contents to that of the selected polyline, turn this toggle on. Note that all geometry in the drawing is effected, even geometry that is outside of the current viewport. Many users will prefer to turn this toggle off, so that they can be prompted to manipulate the geometry.

The bottom row allows you to choose whether to erase all the entities on the inside or outside of the polyline.

Pulldown Menu Location: Edit > Erase
Keyboard Command: erasepline
Prerequisite: Entities and a closed polyline
File Name: \lsp\poly3d.arx

Erase Outside

Function

This command erases all the entities outside of a user specified window. This can be useful if you somehow place entities way outside your drawing limits and want to easily erase them.

Prompts

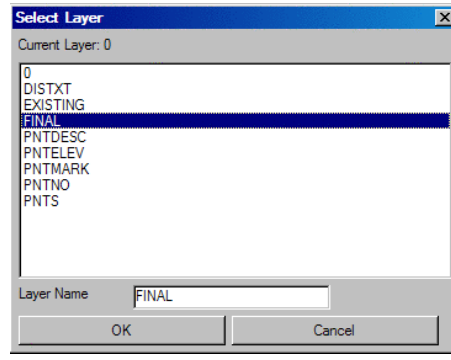
Pick 1st corner of window to erase outside of: *Pick point location*
Pick 2nd corner: *Pick second point location*

Pulldown Menu Location: Edit > Erase
Keyboard Command: eraseout
Prerequisite: Entities to erase
File Name: \lsp\surv1.lsp

Copy To Layer

Function

This command is used to copy a selected entity or entities and put the copy in a specified layer. Once copied to the chosen layer the entity or entities will take on the characteristics of that layer (color, linetype, etc.).



Prompts

Select entities to copy.
Select objects: *select entities*
Select Layer dialog *select a layer from list and click OK*

Pulldown Menu Location: Edit > Copy
Keyboard Command: copy2layer
Prerequisite: Entities to be copied
File Name: \lsp\surv1.lsp

Block Explode

Function

This command retains the values of attributes when a block is exploded. The standard AutoCAD *Explode* command changes the attribute values back to the attribute type. For example, using *Explode*, a Carlson point block would become PNTNO, PNTELEV, PNTDESC. *Block Explode* would keep the point attribute values, such as 10, 1000.0, EP. The layer names of the exploded block attributes can be either the insert layer of the parent block or the original attribute layers from the block definition.

Pulldown Menu Location: Edit
Keyboard Command: explode2
Prerequisite: A block to be exploded
File Name: \lsp\blkattex.lsp

Extend to Intersection

Function

This command extends the end points of two lines and/or polylines, at the same time, to their intersection point.

Prompts

Select first line or polyline to extend: *pick a line or polyline*
Select second line or polyline to extend: *pick another line or polyline*

Before Extend to Intersection

After Extend to Intersection

Pulldown Menu Location: Edit > Extend
Keyboard Command: extint
Prerequisite: Two lines or polylines
File Name: \lsp\poly3d.arx

Extend Arc

Function

This command extends an arc entity.

Prompts

Pick arc to extend: *select an arc entity*
Break Arc at Extension [Yes/<No>]? *N* Answering *Yes* will create a new arc starting at the end of the existing arc.
Enter or pick the distance to extend: *5* This extends the arc 5 units
Enter or pick the distance to extend ('U' to Undo): *press Enter to end*

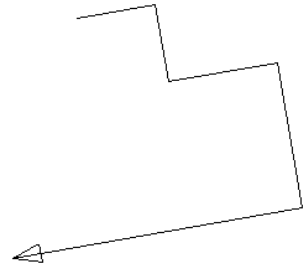
Pulldown Menu Location: Edit > Extend
Keyboard Command: extarc
Prerequisite: An arc
File Name: \lsp\scadutil.arx

Extend by Distance

Function

This command extends a line or polyline, or creates new lines or polylines off of an existing one. By specifying a distance, a new segment of the line or polyline can be drawn from the current position. The current position and direction along the line or polyline is indicated by an arrowhead. Extend by Distance starts by selecting an existing line or polyline. Initially, the current position will be the closest vertex to where the line or polyline was selected. Extending from the endpoint of a polyline will add a new point to that polyline, while extending from any other point will create a new polyline.

There are two modes of operation: draw mode (D) and move mode (M). When in draw mode, extending will draw line or polyline segments. In move mode, the current position arrowhead can be moved without drawing segments. The orientation of the current position arrowhead can be changed with the Right, Left, and Angle commands.

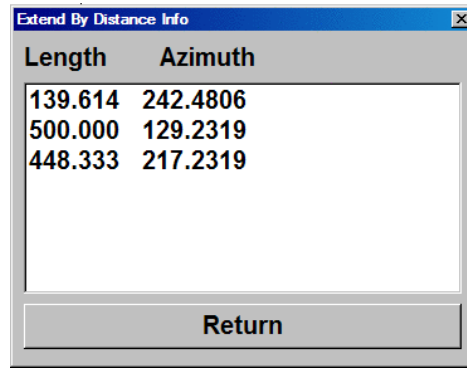


The second prompt for this command offers numerous options in the form of key letters. These key letters are listed below along with their full names and actions. The list of the Extend by Distance commands are:

 # - Number: Distance to draw or extend
A# - Angle change: Rotates pointer by specified number of degrees
A - Align: Rotates pointer to align with segment
B - Bearing: Sets pointer direction by bearing in format: Qdd.mmss with Q- quadrant, d-degrees, m-minutes, s-seconds (e.g. 130.1005 is NE 30 degrees, 10 minutes, and 5 seconds)
C - Close: Closes the polyline
D - Draw Mode: Actions draw or extend the line or polyline
E - Extend to Edge: Extends to intersection with a selected line or polyline

I - Input mode: Toggles distance input between decimal feet and feet-inches
L - Left rotate: Rotates counterclockwise 90 degrees
M - Move Mode: Actions only move the pointer
N - Next: Moves pointer forward to next point
O - Open: Opens the polyline
P - Previous: Moves pointer backward to previous point
R - Right rotate: Rotates clockwise 90 degrees
S - Switch: Reverses pointer direction
T# - Total distance: Sets current segment to specified distance
U - Undo: Undo the last Extend by Distance command
Z - Zoom mode: Toggles auto-zoom between on/off
? - Info: Displays lengths of current polyline

H - Help: The Help option also displays this Extend by Distance Commands list.
Press <Enter>: Ends the routine

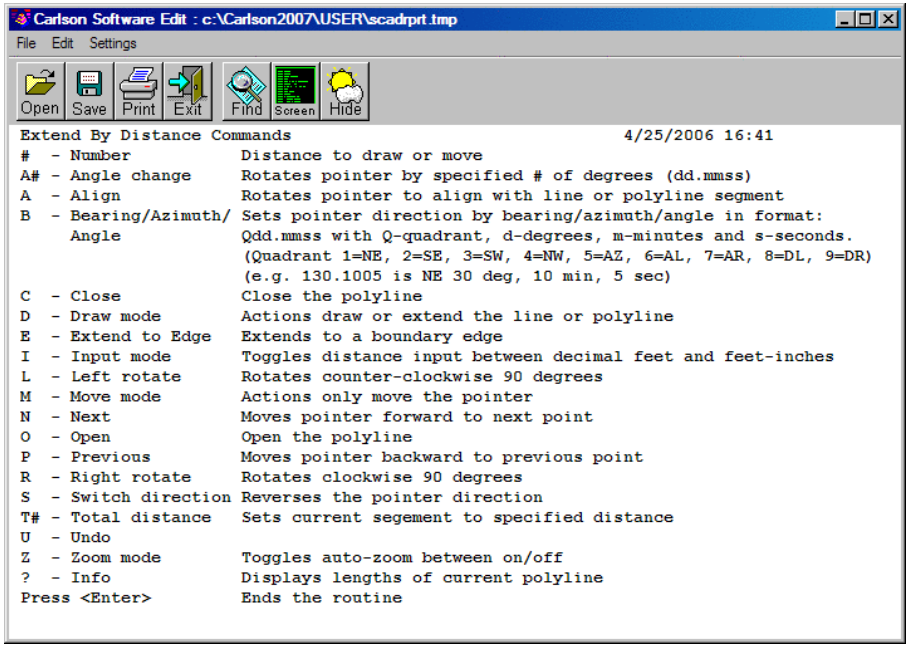


The result of using the Info (?) feature

Prompts

Select line or polyline to extend: *select line or polyline near the place to extend*
Enter or pick distance to draw (A,B,C,E,I,L,M,N,O,P,R,S,T,U,Z,?,Help): *50* The line is extended by 50 units. Use the Pick option to pick a distance.
Pick/Horizontal Distance to Extend ([Enter] for new line): *R* Rotate right 90 degrees.
Enter or pick distance to draw (A,B,C,E,I,L,M,N,O,P,R,S,T,U,Z,?,Help): *50* The line is extended by 50 units. Use the Pick option to pick a distance.

Enter or pick distance to draw (A,B,C,E,I,L,M,N,O,P,R,S,T,U,Z,?,Help): *press Enter*
Extend another (<Yes>/No)? *No*
Note: R50 and L10 can be used to go right 50, left 10, etc.


Carlson Software Edit : c:\Carlson2007\USER\scadrprt.tmp
File Edit Settings
Open Save Print Exit Find Screen Hide
Extend By Distance Commands 4/25/2006 16:41
- Number Distance to draw or move
A# - Angle change Rotates pointer by specified # of degrees (dd.mmss)
A - Align Rotates pointer to align with line or polyline segment
B - Bearing/Azimuth/ Angle Sets pointer direction by bearing/azimuth/angle in format: Qdd.mmss with Q-quadrant, d-degrees, m-minutes and s-seconds. (Quadrant 1=NE, 2=SE, 3=SW, 4=NW, 5=AZ, 6=AL, 7=AR, 8=DL, 9=DR) (e.g. 130.1005 is NE 30 deg, 10 min, 5 sec)
C - Close Close the polyline
D - Draw mode Actions draw or extend the line or polyline
E - Extend to Edge Extends to a boundary edge
I - Input mode Toggles distance input between decimal feet and feet-inches
L - Left rotate Rotates counter-clockwise 90 degrees
M - Move mode Actions only move the pointer
N - Next Moves pointer forward to next point
O - Open Open the polyline
P - Previous Moves pointer backward to previous point
R - Right rotate Rotates clockwise 90 degrees
S - Switch direction Reverses the pointer direction
T# - Total distance Sets current segement to specified distance
U - Undo
Z - Zoom mode Toggles auto-zoom between on/off
? - Info Displays lengths of current polyline
Press <Enter> Ends the routine

The result of using the Help (H) option

Pulldown Menu Location: Edit > Extend
Keyboard Command: extender
Prerequisite: An existing line or polyline with at least one segment from which to start.
File Name: \lsp\scadutil.arx

Break by Crossing Polyline

Function

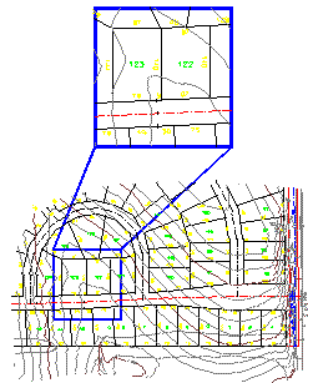
This tool is used to break drawing geometry at the edge of a polyline boundary. It provides options to change the layers of the interior and exterior geometry after it is broken.

First, select the boundary polyline. Only one can be selected. Then select the polylines and lines to be clipped. You will be prompted for options on specifying the layers for the newly broken

geometry. Respond with a "Y" if you want to specify a new layer, then enter the new layer name. If the layer name does not exist, it will be created.

Prompts

Select the clip edge polyline: *pick a closed polyline*
Select the polylines and lines to be clipped.
Select Objects: *pick the entities to break*
Specify layer names for Inside segments (Yes/<No>)? *Yes*
Enter a layer name for the Inside segments <0>: *press Enter*
Specify layer names for Outside segments (Yes/<No>)? *Yes*
Enter a layer name for the Outside segments <0>: *Final*



Pulldown Menu Location: Edit > Break
Keyboard Command: clipline
Prerequisite: A closed polyline
File Name: \lsp\poly3d.arx

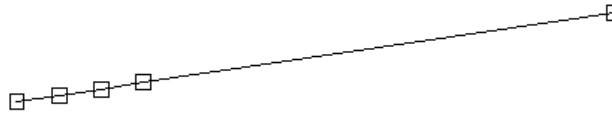
Break Polyline at Specified Distances

Function

This command allows you to pick a polyline and break it at a specified distances along the polyline. Following the prompts below, the beginning of the polyline in the illustration was broken into three 55-foot segments.

Prompts

Select polyline to break: *select polyline*
Total Distance: 779.429 This is the length of the polyline reported.
Distance Along Polyline For Break: *55.0*
Distance Along Polyline For Break (Enter to end): *110*
Distance Along Polyline For Break (Enter to end): *165*
Distance Along Polyline For Break (Enter to end): *press Enter*
3 polyline breaks created.



Pulldown Menu Location: Edit > Break
Keyboard Command: breakpl
Prerequisite: A polyline
File Name:

Break at Intersection

Function

This command will break a line, arc or polyline at the intersection of another line, arc or polyline. In many cases this command is used in conjunction with the *Area by Lines & Arcs* command. In order to get the correct area of a figure, it is often necessary to break it from adjoining lines.

Prompts

Select Line, Arc, or Polyline to Break
Select object: *select object to break*
[int on] Pick Intersection to break at: *pick intersection point*

Pulldown Menu Location: Edit > Break
Keyboard Command: breakat
File Name: \lsp\surv1.lsp

Change Elevations

Function

This command will change the elevation of selected entities. It can move the entity to a specified elevation from it's current elevation (absolute) or do a differential change by adding or subtracting a value from it's current elevation. If Carlson points are selected, their attribute text and z axis coordinate are changed.

Prompts

Ignore zero elevations (<Yes>/No)? *press Enter*If you answer *No*, then entities with elevation 0 will be changed.
[A]bsolute or [D]ifferential Change <A>: *A*
Elevation to change to: *125* By using the Absolute option all entities selected are changed to the elevation 125.
Select Entities for elevation change.
Select objects: *C*
First corner: *pick a point*
Other corner: *pick a point*
Select objects: *press Enter*

If Carlson points are selected, the command warns:
This command DOES NOT change the elevations in the Coordinate file!
Use Coordinate File Utilities menu option F to update the file.

Pulldown Menu Location: Edit > Change
Keyboard Command: chgelev
Prerequisite: Something to change
File Name: \lsp\scadutil.arx

Change Attribute Style

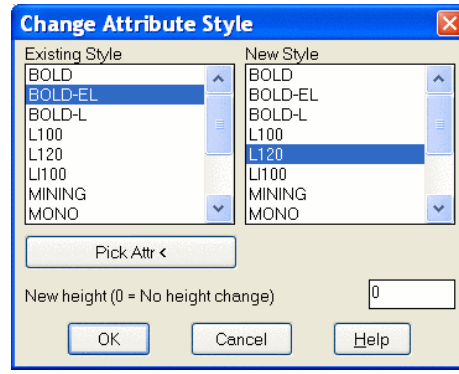
Function

This command will globally change the text style of attributes on the drawing. This can be very useful if all the label styles (such as the point symbol attribute labels) on a drawing must be changed to accommodate a different plotting specification. The default STYLE used for the point symbol attributes is PTXT.

Under **Existing Style**, select the style that is currently applied to the attributes you want to change. If you are unsure of the existing text style, select the **Pick Attr** button, then pick an existing attribute on the screen. When the dialog returns, the text style applied to that attribute will be selected in the list.

Select the **New Style** that you want to apply to the attributes.

Enter a **New Height** for the attributes. An entry of zero (0) will not modify the existing height.



Pulldown Menu Location: Edit > Change
Keyboard Command: chgattr
Prerequisite: You may want to use the *LIST* command to check the current Text size.
File Name: \lsp\chgattr.lsp

Change Style

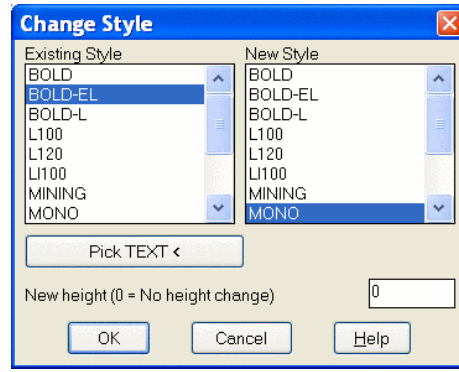
Function

This command will globally change the style and height of text on the drawing. This can be very useful if all the text sizes on a drawing must be changed to accommodate a different plotting scale.

Under **Existing Style**, select the style that is currently applied to the text you want to change. If you are unsure of the existing text style, select the **Pick TEXT** button, then pick an existing text entity on the screen. When the dialog returns, the text style applied to that text entity will be selected in the list.

Select the **New Style** that you want to apply to the text.

Enter a **New Height** for the text. An entry of zero (0) will not modify the existing height.

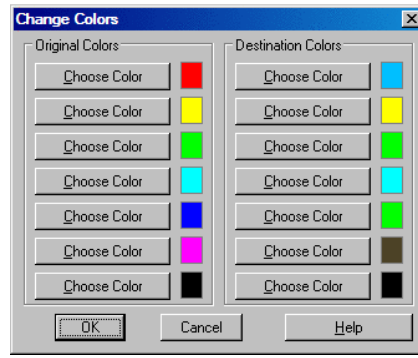


Pulldown Menu Location: Edit > Change
Keyboard Command: chgstyl
Prerequisite: Text entities
File Name: \lsp\chgstyl.lsp

Change Colors

Function

This command is designed to change the original color of existing entities in the drawing to a different color. This is done using the Change Colors dialog. You must match up the original colors of original entities to the the preferred colors that they will change to. These "destination colors" are directly to the right of the original colors in the dialog (on the same row). You then click OK and select the specific entities on-screen that you want changed. This routine changes all entities in the drawing that you have chosen and that have an original color that has been changed. Do your dialog box color selections and matching up first, followed by *OK*. Then select the entities.



Prompts

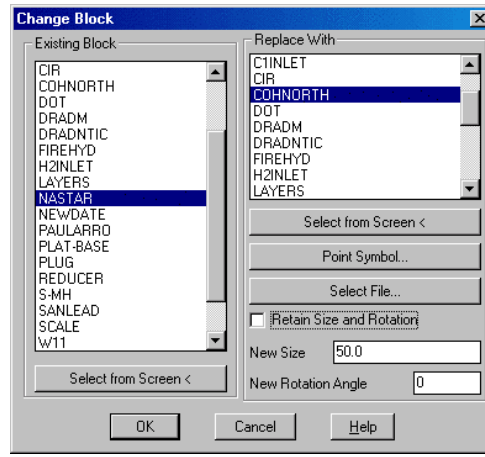
Change Colors dialog Create your color change schemes and click OK.
Select entities to change colors.
Select objects: *select entities*

Pulldown Menu Location: Edit > Change
Keyboard Command: chgcolor
Prerequisite: Entities whose colors are to be changed
File Name: \lsp\poly3d.arx

Change BlockInserts Substitute

Function

This command is used to replace selected block(s) with a different block. The command optionally can change the size and rotation angle. This command will work with Carlson point symbol blocks, or any AutoCAD block. For example, you may receive an AutoCAD drawing from another firm and want to replace certain inserts with inserts of your own specification. In the dialog shown, we are replacing the block named NASTAR with a block named COHNORTH, which will be inserted at 50 scale and zero rotation.



Existing Block: Select the block name to be replaced. If the block name is unknown, choose the Select from Screen button, then select the block from the current drawing.
Replace With: Select the block that will replace the existing block. You may choose from the list of defined blocks, select an existing block from the current drawing, choose a point symbol from the standard Carlson point library, or select an AutoCAD drawing file.
Retain Size and Rotation: When checked, the new block will retain the size and rotation values from the old block.
New Size: Available if Retain Size and Rotation is not checked. Enter the size for the new block.
New Rotation Angle: Available if Retain Size and Rotation is not checked. Enter the rotation angle for the new block.

Pulldown Menu Location: Edit > Change > Block/Inserts
Keyboard Command: chgblk
Prerequisite: None
File Name: \lsp\chgblk.lsp

Change BlockInserts Resize

Function

This command resizes blocks inserts while maintaining their insertion position. When prompted to select objects, choose the inserts to resize. Note that this routine does not rescale attributes that may be associated with the selected inserts.

Prompts

Scaling Multiplier <0.5>: Enter the size scale factor.
Select symbols and blocks to scale.
Select objects: *select entities*

Pulldown Menu Location: Edit > Change > Block/Inserts
Keyboard Command: sizeblk
Prerequisite: block/inserts in drawing
File Name: \lsp\sizeblk.lsp

Pivot Point Rotate by Bearing

Function

This command allows you to rotate the selected entities from the drawing. The rotation angle is defined by the difference between a reference line and an entered bearing or azimuth. The reference line is defined by two points that can be picked on the screen or entered by point number.

Prompts

Select entities to rotate.
Select objects: *select the entities*
Base pivot point ?
Pick point or point number: *2* The program then reads the coordinate value for pt#2 from the current CRD file.
Reference Bearing point ?
Pick point or point number: *pick a point*
Reference Bearing N 44d31'1" E The program then displays the reference bearing defined by the two points selected.
Azimuth/<Bearing (Qdd.mmss)>: *245.3030* Enter an A to input an Azimuth or enter the bearing. The above response is a bearing of South 45 degrees, 30 minutes, and 30 seconds East. The program then rotates the database to the new bearing.

If Carlson Points are selected the program warns:
This command DOES NOT change the coordinates in the CooRDinate file!
Use CooRDinate File Utilities menu, Update CRD from Drawing.
This warning applies if the points entities are not linked to the CRD file. This link option is set in the Configure command.

Pulldown Menu Location: Edit > Rotate
Keyboard Command: brot
Prerequisite: None
File Name: \lsp\scrot.lsp

Entity Insertion Point Rotate

Function

This command allows you to rotate the selected entities from the drawing where they will follow one of the following alignments: Twist screen, Azimuth, Entity Segment, Follow or Pick.

Prompts

Rotate by [<Twist screen>/Azimuth/Entity segment/Follow/Pick]? *F*
Select polyline to follow: *pick a polyline*
Select Entities to Rotate.
Select objects: *pick entities to rotate*
Flip text for twist screen [Yes/<No>]? *Y*
Rotating ....

Pulldown Menu Location: Edit > Rotate
Keyboard Command: ss_twist
Prerequisite: None
File Name: \lsp\scrot.lsp

Text Enlarge/Reduce

Function

This command will scale text entities up or down in size. The routine prompts for a scale multiplier and a selection set of text objects. If you want to enlarge the text enter a value greater than one. If you want to reduce text enter a decimal fraction such as .5. This would reduce the text size by 50%. This command is very useful if you have set up your drawing for one plotting scale and decide to change to a new plotting scale. The Change Text Size command can alternatively be used to set the text size to a specific value.

Pulldown Menu Location: Edit > Text
Prerequisite: Text entities to be changed
Keyboard Command: txtenl
File Name: \lsp\surv1.lsp

Rotate Text

Function

This command sets the rotation of the selected text to the current twist screen, an entered azimuth, or to align with a line or polyline. The text keeps the same insertion point and justification. The *Twist Screen* option sets the text rotation to align horizontal with the current twist screen. With the *Azimuth* option you can enter the angle or pick two points to define the text rotation. The *Entity segment* aligns the text with a selected line or polyline segment. The *Follow* option aligns the text with the closest polyline segment.

Prompts

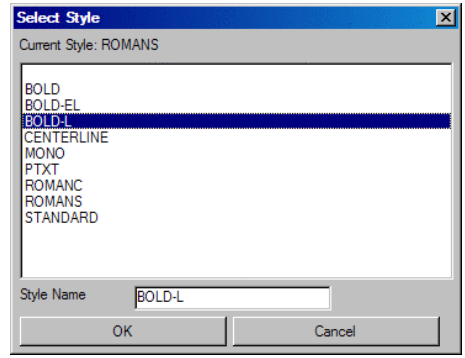
Rotate by (<Twist Screen>/Azimuth/Entity segment/Follow/Pick)? *press Enter*
Enter angle relative to current twist screen <0.0>: *23*
Select Text to rotate.
Select objects: *select the text*

Pulldown Menu Location: Edit > Text
Keyboard Command: twisttxt
Prerequisite: Text
File Name: \lsp\twisttxt.lsp

Change Text Font

Function

This command can change multiple text entities to a user specified style. The routine prompts for a selection set of TEXT and/or MTEXT objects. Once the selection is made, the Select Style dialog appears. You can then select a text Style Name, such as MONO or ROMANS, that you would like to change to. Click OK. To the right on Style Name, you can enter a style name that does not exist. If you do, it will be created for you using the font with the same name.



Pulldown Menu Location: Edit > Text
Keyboard Command: chgtxtstyle
Prerequisite: Text entities to be changed
File Name: \lsp\chtxtst.lsp

Change Text Size

Function

This command will change the size of the selected text objects to the user specified size. The *Text Enlarge/Reduce* command also changes text size. The difference is that this routine sets the text to an absolute size whereas *Text Enlarge/Reduce* scales, or relatively changes, the text size.

Prompts

Select the text to size.
Select objects: *select the text*
Enter new text size: *enter value*

Pulldown Menu Location: Edit > Text
Keyboard Command: chgtxtsize
Prerequisite: Text entities to be changed
File Name: \lsp\surv1.lsp

Change Text Width

Function

This command changes the width of the selected text entities, after a new width factor is entered. The insertion point of each text entity is maintained as the routine lengthens or shortens the text.

Effect of different width factors on the same text line

Prompts

Select the text to change.
Select objects: *select text entities*
Enter new width factor <1.0>: *enter new width factor*

Pulldown Menu Location: Edit > Text
Keyboard Command: chgtxtwidth
Prerequisite: Text entities to be changed
File Name: \lsp\surv1.lsp

Change Text Oblique Angle

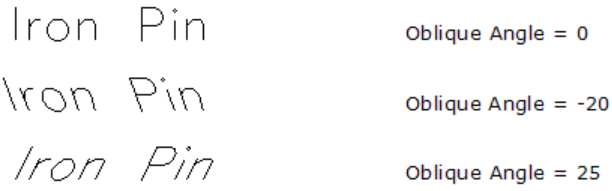
Function

This command allows you to change the text oblique angle on existing text in the drawing. The oblique angle for a specific text style is defined during the creation of the style. The default value for the oblique angle for text styles is 0 until defined to another value by the user. When changing the oblique angle, a minus (-) sign in front of the angle indicates a backward slant and a positive

value results in a forward slant. Remember that the reference base point for the oblique change is always 0 degree. This means that if an existing text string has an oblique angle of 20, changing the oblique angle to 25 will not add 25 degrees to the existing 20 degree oblique resulting in a text oblique angle of 45 degrees, but rather a 25 degree oblique will be established by referencing 0 oblique as the base, and then slanting the text to 25 degrees. This works the same for slanting text backward as well as forward. Below is an example showing original text created with the default oblique angle of zero, then changed to a backward slant of 20 and a forward slant of 25 degrees.

Prompts

Select the text to change.
Select objects: *Select text to change oblique angle on*. Note that one or more text strings can be selected. When all desired text has been selected, press Enter.
Enter new oblique angle <0.0>: Enter the desired oblique angle.



Pulldown Menu Location: Edit > Text
Prerequisite: Text entities to be changed
Keyboard Command: chgtxtoblique
File Name: \lsp\surv1.lsp

Flip Text

Function

This command will change the alignment of text entities by 180 degrees.

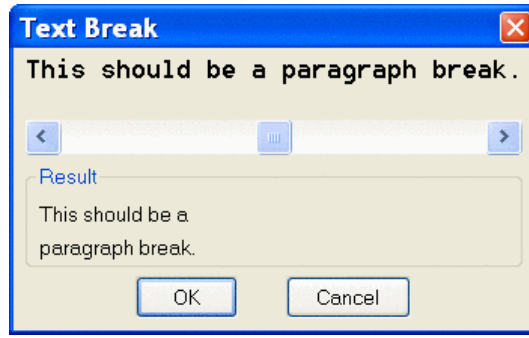
Pulldown Menu Location: Edit > Text
Keyboard Command: fliptext
Prerequisite: Text entities to be changed

File Name: \lsp\surv1.lsp

Split Text into Two Lines

Function

This tool allows you to break a single line of TEXT into two separate lines. First, select the text string you would like to break. The Text Break dialog then appears. Initially, the slider is all the way to the right. Begin dragging it toward the left until it reaches the point where the split is at the desired position. Then choose OK to complete the break operation.



Pulldown Menu Location: Edit > Text
Keyboard Command: txtbrk
Prerequisite: Text entity to break
File Name: \lsp\txtbrk.lsp

Text Explode To Polylines

Function

This command converts the selected text into polylines. This function is generally used when preparing a plan view file for machine control, before using the *Write Polyline File* command.

Prompts

Select text to be EXPLODED.
Select objects: *select the text*

Substitute With Simple Font [<Yes>/No]? *Y*
1 text object(s) have been exploded to lines.
The line objects have been placed on layer 0.
Reading the selection set ...
Joining ...
Converting ...

Pulldown Menu Location: Edit > Text
Keyboard Command: textexp
Prerequisite: Text
File Names: \lsp\textexp.lsp, \lsp\poly3d.arx

Replace Text

Function

This command will replace one text string with another. For example, if the text LEGEL is on a drawing, you could use this command to replace it with LEGAL. In AutoCAD 2000 and later, the command *Find and Replace Text* includes more options, including replacing partial strings and searching attributes and MTEXT.

Pulldown Menu Location: Edit > Text
Keyboard Command: chgtext
Prerequisite: Text entities to be changed
File Name: \lsp\chgtext.lsp

Select by Elevation

Function

This command builds a selection set of entities that are greater than, less than or in between a specified elevation that you enter in on the command line. Entities selected, based upon this elevation criteria, go into a selection set. With the Window selection method, the entities must be entirely inside of the inclusion area to be included in the selection set. With the Crossing selection method, an entity is added to the selection set if any part of the entity is inside the inclusion area.

Prompts

Select by greater, less or between elevations [<Greater>/Less/Between]? *press Enter*

Enter elevation for greater than: *19*
Ignore zero elevations [<Yes>/No]? *press Enter*
Select objects to build selection set. *pick objects*
Processing selection set ...
Built selection of 120 objects for elev more than 19.00.
To use type 'P' at Select objects: prompt.

Pulldown Menu Location: Edit > Selection Sets
Keyboard Command: zselect
Prerequisite: Entities
File Name: \lsp\volcalc.arx

2D Align

Function

This command will align (translate, rotate and scale) the selected objects using two pairs of source and destination control points. The difference between the first source point and first destination point determines the translation amount. The difference between the angle and distance from the first and second source points compared to the angle and distance from the first and second destination points determines the rotation and scale. The scale part of the alignment is optional. This 2D Align function is the same as the AutoCAD Align function except that this 2D Align function does not use elevations so that the alignment is always in 2D. The control points can be screen picked or entered by point numbers.

Prompts

Select entities to align.
Select objects: *pick entities to process*
First Source Point?
Pick point or point number: *pick a point*
First Destination Point?
Pick point or point number: *pick a point*
Second Source Point?
Pick point or point number: *pick a point*
Second Destination Point?
Pick point or point number: *pick a point*
Scale factor: 1.00434258
Scale objects based on alignment points [Yes/<No>]? *Y*

This command DOES NOT change the coordinates in the CooRDinate file!
Use Coordinate File Utilities menu, Update CRD File from Drawing.

Pulldown Menu Location: Edit > Align
Keyboard Command: scalign
Prerequisite: None
File Name: \lsp\scalign.lsp

Entities to Polylines

Function

This command converts selected lines, arcs, circles, 3DFaces, ellipses, splines, multilines, regions and solids into individual polylines. Use *Join Nearest* to convert adjoining lines and arcs into continuous polylines.

Prompts

Select lines, arcs, circles, 3DFaces, ellipses, splines, multilines, regions and solids to convert.
Select objects: *select entities*

Pulldown Menu Location: Edit > Polyline Utilities
Keyboard Command: topline
Prerequisite: lines, arcs or other entities to convert
File Name: \lsp\poly3d.arx

Reverse Polyline

Function

This command reverses the order of the line and/or arc segments of a *POLYLINE*. This can be useful in conjunction with the commands *Station Polyline*, *MXS by Polyline*, *Profile from Surface Model* or *CL File from Polyline*, since the polyline must be plotted in the direction of increasing stations. If it is more convenient to draft a polyline in one direction do so and then use the

Reverse Polyline command to change it's order. Temporary arrows along the polyline are drawn to graphically show the new polyline direction.

Prompts

Select the Polyline to Reverse: *pick a point on polyline*

Puldown Menu Location: Edit > Polyline Utilities
Keyboard Command: revpline
Prerequisite: A polyline
File Names: \lsp\revpline.lsp, \lsp\poly3d.arx

Reduce Polyline Vertices

Function

This command removes points from a polyline, without significantly changing the polyline. The offset cutoff is the maximum amount that the polyline can move horizontally and vertically when removing a point. For example, in a polyline with three points in a straight line, the middle point can be removed without changing the polyline. This command is explained further in the *Triangulate & Contour* command.

Prompts

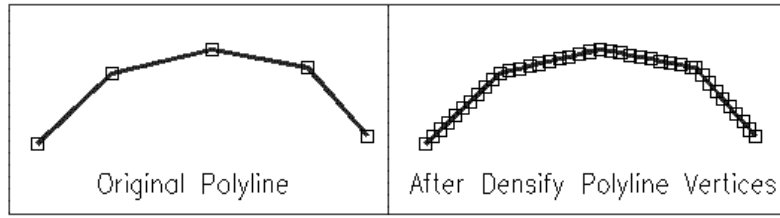
Enter the offset cutoff <0.1>: *.5*
Select polylines to reduce.
Select objects: *pick polylines*
Processed polylines: 1
Total number of vertices: 10
Number of vertices removed: 1

Pulldown Menu Location: Edit > Polyline Utilities
Keyboard Command: reduce
Prerequisite: A polyline
File Name: \lsp\tri4.arx

Densify Polyline Vertices

Function

This command adds vertices to the selected polylines at the specified interval. These points are interpolated between existing points in the polyline. This command is the opposite of Reduce Polyline Vertices.



Prompts

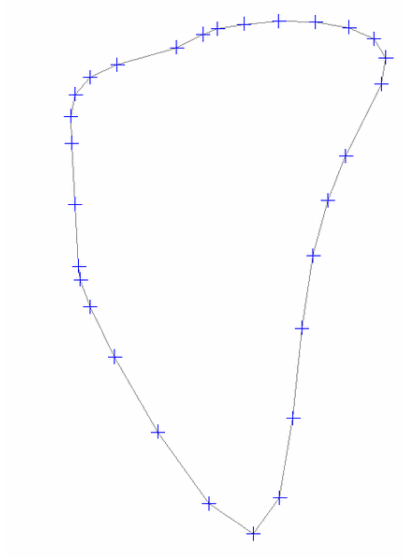
Select polylines to densify.
Select objects: *select polylines*
Point interval <10.0>: *press Enter*
Testing Entity> 1
Added 17 points to 1 polyline.

Pulldown Menu Location: Edit > Polyline Utilities
Keyboard Command: densepl
Prerequisite: A polyline
File Name: \lsp\poly3d.arx

Draw Polyline Blips

Function

This command will draw temporary markers, "blips", at each polyline vertex. This allows you to identify the actual location of each vertex. The Blips are temporary. Any change to the viewport (pan, zoom, regen) will make the blips disappear. In later versions of AutoCAD, you can also click on the polyline to activate the grips which will remain visible during and after viewport changes.



Prompts

Select polylines to draw blips.
Select objects: *select polyline(s)*

Pulldown Menu Location: Edit > Polyline Utilities
Keyboard Command: plblip
Prerequisite: A polyline
File Name: \lsp\poly3d.arx

Set Polyline Origin

Function

This command sets the starting vertex of a closed polyline. Simply pick the polyline and then pick near the point to set as the starting point.

Prompts

Select Polyline: *pick a polyline*

Pick Near New Origin Point: *pick a point on the polyline to be the starting point*
Processing ...
Select Polyline: *press Enter*

Pulldown Menu Location: Edit > Polyline Utilities > Edit Polyline
Keyboard Command: plchgorg
Prerequisite: A closed polyline
File Name: \lsp\plchgorg.lsp

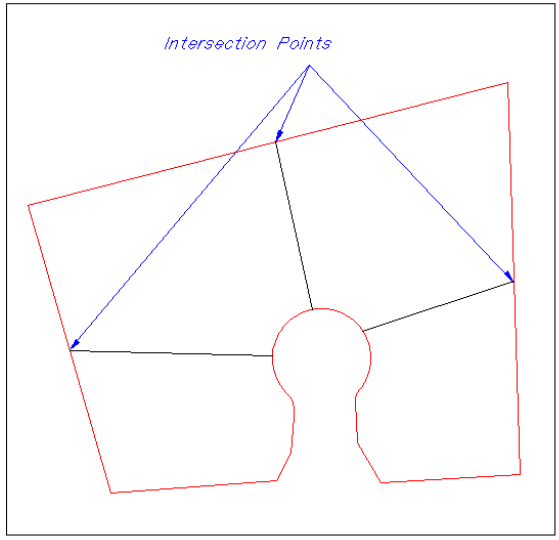
Add Intersection Points

Function

This command adds points into lines or polylines where there are intersections. This can be useful for other commands such as Auto-Annotate. For example in the drawing shown, Add Intersection Points adds points to the boundary polyline where the lot lines intersect. Then Auto Annotate for the boundary polyline will label the boundary distance along each lot. This routine does not add intersection points on arcs.

Prompts

Select lines and polylines to check.
Select objects: *pick lines or polylines*
Reading the selection set ...
Adding intersection points ...
Added 3 intersection points.



Pulldown Menu Location: Edit > Polyline Utilities > Edit Polyline
Keyboard Command: addint
Prerequisite: Polylines or lines
File Name: \lsp\poly3d.arx

Add Polyline Vertex

Function

This command adds points into a polyline. First you select the polyline to modify. The existing polyline vertices are marked and then you can pick or enter the coordinates for the new point(s). A new point is inserted into the polyline at the nearest polyline segment. On a 3D polyline, the elevation of the new vertex will be calculated for you. You can continue to pick points to add. Press Enter when you are done.

Prompts

Select polyline to add to: *pick a polyline*
Pick or enter point to add: *pick a point*
Select polyline to add to: *press Enter to end*

Pulldown Menu Location: Edit > Polyline Utilities > Edit Polyline
Keyboard Command: addpl
Prerequisite: A polyline
File Name: poly3d.arx

Edit Polyline Vertex

Function

This tool allows you to make changes in the coordinates of vertices on all polyline types. Upon execution, you will be asked to select a polyline to edit. Upon selection, a temporary marker will be placed at all of the vertices of the polyline, making them easy to distinguish. You must then pick near the vertex you wish to edit. The following dialog appears.

At the top of the dialog it identifies the type of polyline as being 2D or 3D. In the case of 2D polylines, it allows you convert the polyline. You have the ability to type in new northing, easting or elevation values. You can also determine the 3D coordinate position by using distances and slope to/from adjacent points. As you change the values in the dialog, new values for derivatives are being calculated. For example, if you change the horizontal distances, the coordinates will change.

Prompts

Select polyline to edit: *pick a polyline*
Pick point on polyline to edit: *pick a point to be modified*
Edit Polyline Vertex dialog *click "Pick Position"*
Pick vertex position: *pick a new location for the vertex*
Edit Polyline Vertex dialog *click OK*
Make changes as needed. You will see the polyline vertices relocationed based upon the the new picked positions and coordinate changes. Use Previous and Next to move along the polyline. Note the dialog values changing.
Select polyline to edit (Enter to end): *press Enter to end*

Pulldown Menu Location: Edit > Polyline Utilities
Keyboard Command: editpl
Prerequisite: A polyline
File Name: \lsp\poly3d.arx

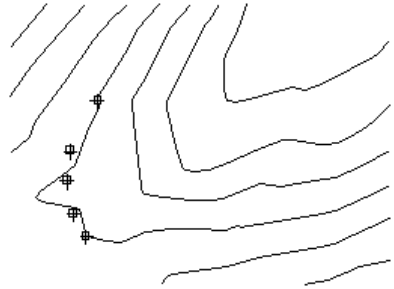
Edit Polyline Section

Function

This command revises a segment of a polyline. Begin by picking a point on the polyline where you want to start editing. Then pick new points for the polyline. When finished picking new points press Enter, and then pick a point on the polyline to connect with the new points. The polyline segment between the start and end points is then replaced with the new points.

Prompts

Select polyline to edit: *pick the polyline at the place to start editing*
Pick intermediate point (Enter to End): *pick a point*
Pick intermediate point ('U' to Undo, Enter to End): *pick a point*
Pick intermediate point ('U' to Undo, Enter to End): *press Enter*
Pick reconnection point on polyline: *pick the polyline at the place to join*



Edit this contour by picking new points

Contour with segment replaced with new points

Pulldown Menu Location: Edit > Polyline Utilities > Edit Polyline
Keyboard Command: editpl2
Prerequisite: Polylines
File Name: \lsp\poly3d.arx

Remove Duplicate Polylines

Function

This command analyzes the selected polylines and erases any duplicate polylines found. They must be exactly the same for one to be deleted.

Prompts

Select lines, arcs and polylines to process.
Select objects: *select linework to process*
Reading the selection set ...

Removed 1 duplicate linework entities.

Pulldown Menu Location: Edit > Polyline Utilities > Remove Polyline
Keyboard Command: rmduplwork
Prerequisite: Polylines that have duplicates
File Name: poly3d.arx

Remove Polyline Arcs

Function

This command replaces arc segments in polylines with chords. Removing arcs is a prerequisite to some Carlson commands that don't handle arcs, such as *Break by Closed Polyline* and *Make 3D Grid File*. This process can add many vertices to the polyline. The Offset cutoff is the maximum any point on the arc will be allowed to shift.

Prompts

Select polylines to remove arcs from.
Select objects: *pick polylines*
Offset cutoff <0.5>: *press Enter*

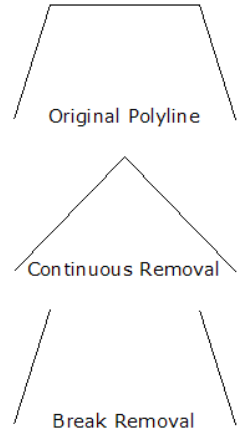
Pulldown Menu Location: Edit > Polyline Utilities > Remove Polyline
Keyboard Command: rmarc
Prerequisite: polyline with arcs
File Name: \lsp\poly3d.arx

Remove Polyline Segment

Function

This command removes the user specified segment from a polyline. A polyline segment is the section between two vertices of the polyline. There are two options for removing the segment. Either the two vertices of the removed segments are averaged together to keep polyline continuous, or the segment is left missing in the polyline, which creates two separate polylines. The keywords Continuous and Break respectively identify these two options. The first image is of the Original Polyline. The second is with the Continuous Removal option. The third is using

the Break Removal option.



Prompts

Break polyline at removal or keep continuous (Break/<Continuous>)? *press Enter*
Select polyline segment to remove: *pick point on polyline*
Select polyline segment to remove: *press Enter to end*

Pulldown Menu Location: Edit > Polyline Utilities > Remove Polyline
Keyboard Command: removepl
Prerequisite: A polyline
File Names: \lsp\removepl.lsp, \lsp\poly3d.arx

Remove Polyline Vertex

Function

This command removes vertices from a polyline. First you select the polyline to modify. The existing polyline vertices are marked and then you pick near the vertex you wish to delete. You can continue to pick vertices to delete, press Enter when you are done.

Prompts

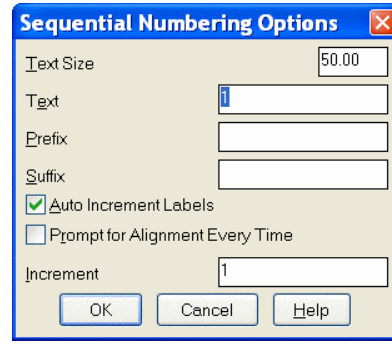
Select polyline to remove from: *pick point on polyline*
Pick point to remove: *pick point*
Pick point to remove (Enter to end): *press Enter to end*

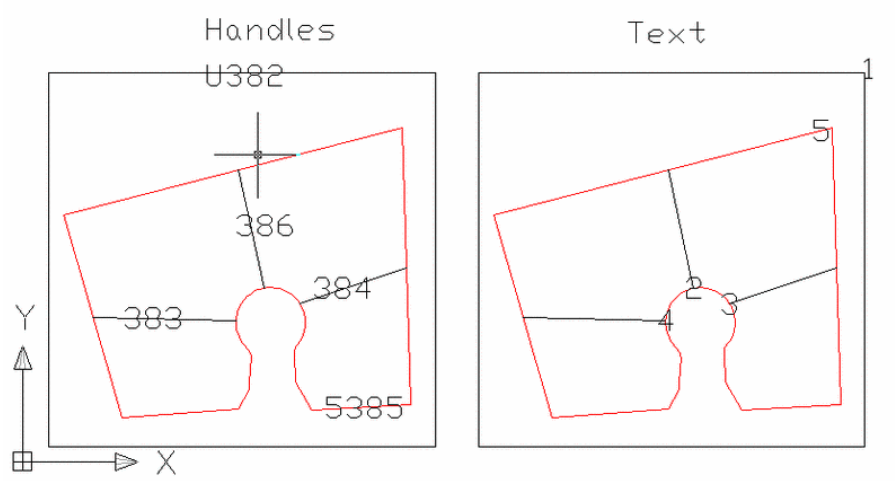
Pulldown Menu Location: Edit > Polyline Utilities > Remove Polyline
Keyboard Command: rmvertex
Prerequisite: A polyline
File Name: \lsp\poly3d.arx

Create Polyline ID Labels

Function

This command labels the selected polylines with either the AutoCAD "Handle", which can be seen with a list, or with unique text numbers, such as 1, 2, 3, 4, etc.. When using the Text option, the following window appears to choose the text settings.





Prompts

Select Polylines to label.
Select objects: *pick polyline*
Label polylines by Text or Handles [Handles/<Text>]? *press Enter*

Pulldown Menu Location: Edit > Polyline Utilities
Keyboard Command: label_polys
Prerequisite: A polyline
File Name: \lsp\poly3d.arx

Smooth Polyline

Function

This command smooths the selected polylines using a modified Bezier method that makes the smooth polyline pass through all the original points and only smooths between the original points. The looping factor controls smoothing amount. A higher factor gives more looping. This command is explained further in the Surface menu section.

Prompts

Enter the looping factor (1-10) <5>: *7*

Enter the offset cutoff <0.05>: *press Enter* This is the same reducing filter described above.
Select polylines to smooth.
Select objects: *pick polylines*
Smoothed 1 PolyLines
Total original vertices: 9 Total final vertices: 50

Pulldown Menu Location: Edit > Polyline Utilities
Keyboard Command: smoothpl
Prerequisite: A polyline
File Name: \lsp\tri4.arx

Change Polyline Width

Function

This command sets the width of the selected polylines. In later versions of AutoCAD, the command *PEDIT* can also modify the width of multiple polylines.

Prompts

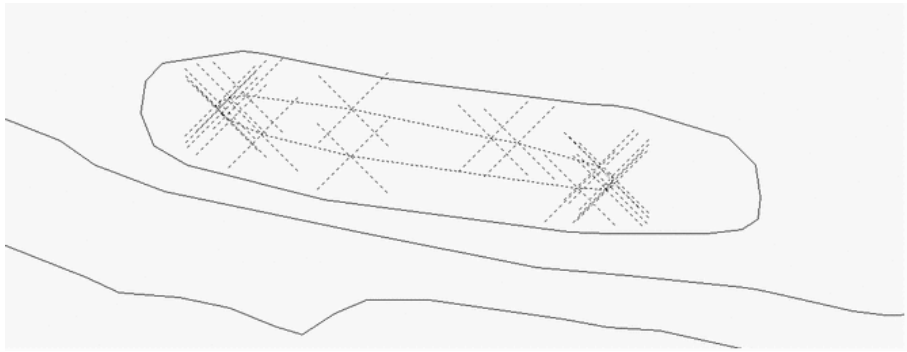
New width <1.0>: *2*
Select Polylines/Contours to change width of:
Select objects: *pick polylines*

Pulldown Menu Location: Edit > Polyline Utilities > Edit Polyline
Keyboard Command: cwidth
Prerequisite: A polyline
File Name: \lsp\surv1.lsp

Check Elevation Range

Function

This command analyzes a selection set of polylines, and highlights the ones that fall outside of a specified elevation range. There is an option to set the polylines that are outside of the range to zero. Every polyline vertex that is outside of the range will be highlighted with an X.



Prompts

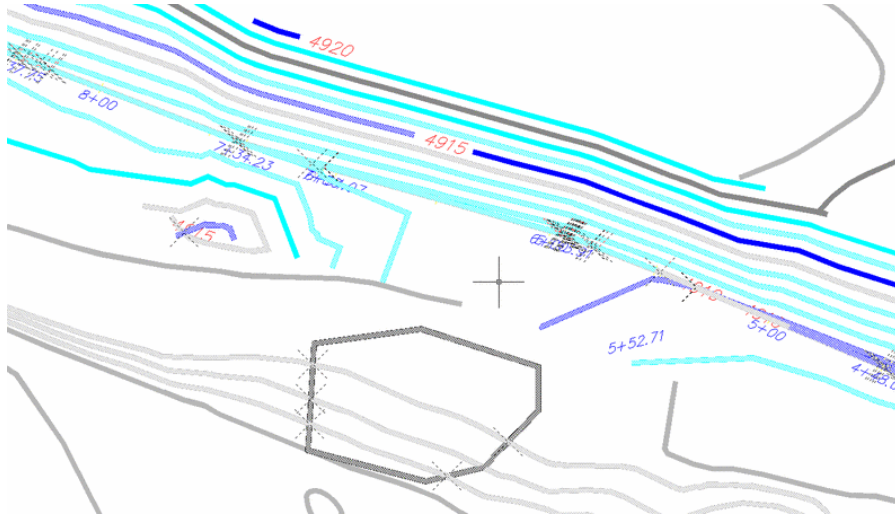
Enter elevation range minimum: *0*
Enter elevation range maximum: *4900*
Select polylines to check.
Select objects: *pick polylines to process*
Found 1 polylines outside of elevation range.
Set polylines outside elevation range to zero elevation [Yes/<No>]? *N*

Pulldown Menu Location: Edit > Polyline Utilities
Keyboard Command: checkpl
Prerequisite: Polylines with elevations
File Names:

Highlight Crossing Plines

Function

This command highlights selected polylines that are crossing in the drawing. Every intersection point where the polylines cross are marked with an X. A report is provided at the end where the X and Y of the intersection points are displayed with the two Z values and the Z difference.



Carlson Software Edit : c:\Carlson2007\USER\scadrprt.tmp

File Edit Settings

Open Save Print Exit Find Screen Hide

Crossing Breaklines Report 4/4/2006 15:00

Intersection	X	Y	Z1	Z2	Delta Z
1	544093.6085	160501.4266	1540.0000	0.0000	1540.0000
2	544244.8235	160540.6909	1540.0000	0.0000	1540.0000
3	544244.7077	160538.8089	1540.0000	0.0000	1540.0000
4	544158.7792	160696.2540	1540.0000	0.0000	1540.0000
5	544249.8746	160816.5767	1520.0000	0.0000	1520.0000
6	544332.9374	160495.1421	1520.0000	0.0000	1520.0000
7	543998.8958	160456.7193	1520.0000	0.0000	1520.0000
8	544154.6199	160751.1884	1520.0000	0.0000	1520.0000
9	544191.4615	160816.5767	1520.0000	0.0000	1520.0000
10	544990.2285	160281.4517	1500.0000	0.0000	1500.0000
11	544146.4027	160797.0493	1500.0000	0.0000	1500.0000
12	543927.0323	160425.3034	1500.0000	0.0000	1500.0000
13	544426.2473	160413.1184	1500.0000	0.0000	1500.0000

Prompts

Select polylines to check.

Select objects: Specify opposite corner: 32 found
Reading points ... 1677
Finding points on breaklines ...
19 crossing polylines are highlighted.
Minimum delta Z to report <0.0>: 2
Add polyline vertices at intersections with average elevation [Yes/<No>]? *N*

Pulldown Menu Location: Edit > Polyline Utilities
Keyboard Command: xing_plines
Prerequisite: Polylines with elevations

Highlight Unclosed Polylines

Function

This tool will evaluate polylines you select and highlight those that are open. It also provides options to close all or selected polylines from those found.

First select all polylines to evaluate. The tool will then display those that are open in a highlighted appearance. You will be offered an option to close all or selected polylines. If you wish to close all the open polylines, choose the All option. If you choose the Selected option you will be prompted to pick which polylines you want to close. As you pick each polyline it will be closed.

Prompts

Select the polylines to check.
Select objects: *pick polylines to process*
Open polylines are highlighted.
Close all or selected polylines [All/<Selected>]? *S*
Pick polyline to close: *press Enter to end or select polylines*

Pulldown Menu Location: Edit > Polyline Utilities
Keyboard Command: unclosed
Prerequisite: A polyline
File Name: \lsp\surv1.lsp

Close/Open Polylines

Function

These commands allow you close or open multiple polylines respectively. In AutoCAD 2000 and higher, you can also use the PEDIT command.

Pulldown Menu Location: Edit > Polyline Utilities > Edit Polyline
Keyboard Command: closepl, openpl
Prerequisite: A polyline
File Name:

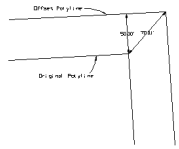
Buffer Offset

Function

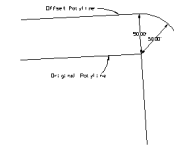
This command offsets a polyline, and maintains a fixed distance from the original polyline by placing an arc on convex corners. The standard AutoCAD *Offset* command can actually have a distance greater than the offset at corners. In the example shown, the distance between the corners of the original and offset polylines is 70.01, while the offset distance is 50.0. *Buffer Offset* makes an offset polyline that doesn't exceed the offset distance. This is useful when you want an offset that goes no further than the offset distance, such as wetland offsets. Later versions of AutoCAD can achieve the same effect using the standard *Offset* command by changing the system variable OFFSETGAPTYPE to 1.

Prompts

Enter the offset amount: *50*
Select object to offset: *pick the original polyline*
Specify point on side to offset: *pick a point on the side to offset to*



Regular Offset



Buffer Offset

Pulldown Menu Location: Edit > Offset
Keyboard Command: boffset

Prerequisite: A polyline to offset
File Name: \lsp\crdutil.arx

Fillet 3D Polyline

Function

This command fillets two segments of a 3D polyline with the given radius. AutoCAD's *FILLET* command does not support 3D Polyline entities. Since 3D polylines cannot have arcs, this command draws the fillet arc as a series of short chords. The elevations along the curve are interpolated from the 3D polyline.

Prompts

Fillet corner of a polyline or intersection of two polylines [<Corner>/Intersection]? *press Enter*
Enter fillet radius <10.00>: *press Enter*
Select a corner point on polyline: *pick 3D polyline near meeting point of two segments*
Select a corner point on polyline: *pick 3D polyline near meeting point of two segments*
Select a corner point on polyline: *press Enter* (to end command)

Pulldown Menu Location: Edit > 3D Polyline Utilities
Keyboard Command: fillet3d
Prerequisite: 3D polyline
File Name: \lsp\poly3d.arx

Join 3D Polyline

Function

This command joins *3DPOLY* entities into a single 3D polyline entity.

Prompts

Select the 3D polyline to join: *pick a 3D polyline*
Select the other 3D polyline to join: *pick a 3D polyline that has a common endpoint with the first*
3 segments added to the polyline.

Pulldown Menu Location: Edit > 3D Polyline Utilities
Keyboard Command: join3d
Prerequisite: Plot the *3DPoly* lines to use for selection
File Names: \lsp\join3d.lsp, \lsp\poly3d.arx

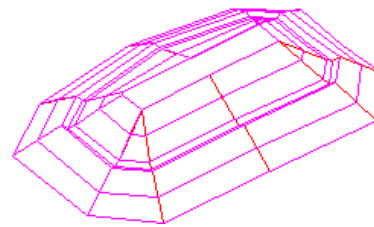
Offset 3D Polyline

Function

This command allows you to offset a 3D polyline entity in both the horizontal and vertical directions. There are three offset methods. The Interval method applies one horizontal and one vertical offset to all the vertices of the polyline. The Constant method has a horizontal offset and sets the elevation of the polyline to one constant elevation. The Variable method allows you to specify each horizontal and vertical offset individually either by polyline segment or for each point. The vertical offset can be specified by actual vertical distance, percent slope or slope ratio.

Prompts

Enter the offset method [<Interval>/Constant/Variable]: *press Enter*
Vertical/<Horizontal offset amount>: *15*
Percent/Ratio/Vertical offset amount <0>: *10*
Select a polyline to offset (Enter for none): *select a 3D poly*
Select side to offset: *pick a point*
Select a point on the graphics screen that is in the direction of the side of line to offset.
Select a polyline to offset (Enter for none): *press Enter*

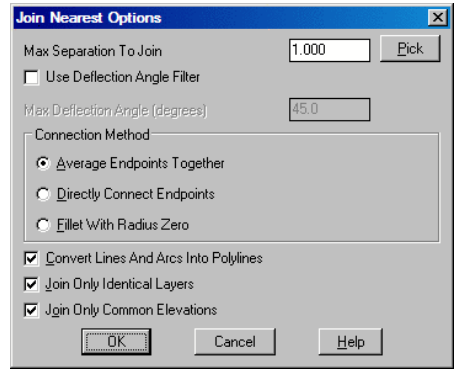


Pulldown Menu Location: Edit > 3D Polyline Utilities
Keyboard Command: offset3d
Prerequisite: Plot the *3DPoly* lines to use for selection.
File Name: \lsp\poly3d.arx

Join Nearest

Function

This command joins lines, arcs and/or polylines together. While AutoCAD's *PEDIT-Join* command requires the endpoints to match, Join Nearest will allow you to join entities whose endpoints do not exactly meet. You specify the maximum separation distance to join, along with other options, in the dialog box shown below. You can join many entities at once.

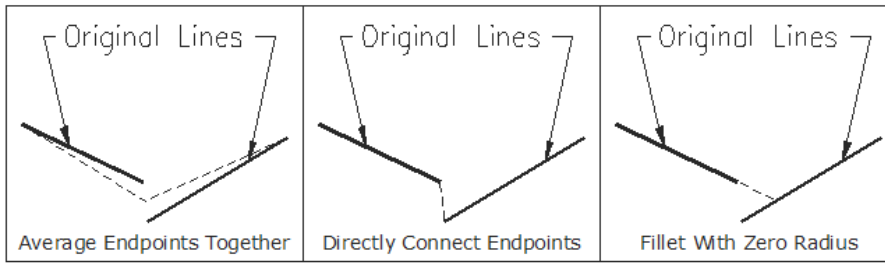


Max Separation to Join: Entities whose endpoints are spaced apart greater than this value will not be joined. You may use the pick button to specify this value by picking two points on the screen.
Max Deflection Angle (degrees): This option will not join any lines if the angle between them is greater than this angle in degrees.
Connection Method: Determines how to connect the endpoints. See the illustration below.

1. **Average Endpoints Together:** New vertex will be located at midpoint between two original endpoints (see illustration below on left).
2. **Directly Connect Endpoints:** Original endpoints are connected with new segment (see the middle illustration below).
3. **Fillet with Radius Zero:** Same as AutoCAD *FILLET* command using zero radius (see the illustration on right).

Convert lines into polylines: When checked, automatically converts lines and arcs into polylines. If not checked, lines and arcs are joined but remain separate entities.

Join only identical layers: When checked, only entities on the same layer will be joined.
Join only common elevations: When checked, only endpoints located on the same elevation will be joined.

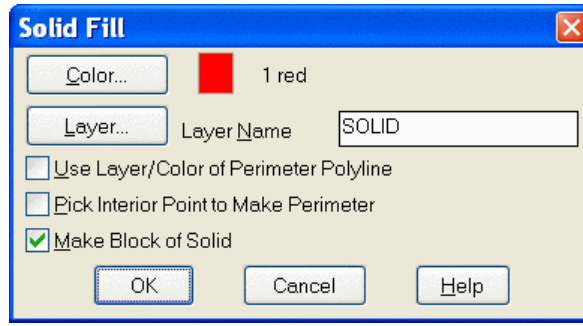


Pullown Menu Location: Edit
Keyboard Command: nearjoin
Prerequisite: Lines or polylines to be joined
File Names: \lsp\nearjoin.lsp, \lsp\poly3d.arx

Solid Fill Polyline

Function

This command fills the interior of closed polylines with 3D Faces to make the polyline areas appear solid. Closed polylines for exclusion areas can be used to exclude areas from the fill. Text can also be selected to exclude the text area from the fill. As an alternative, you can use the AutoCAD *HATCH* command, which creates an associative link between the hatch object and its boundary, interior boundary and any text that is excluded.



Prompts

Solid Fill Dialog Box
Use Layer/Color of Perimeter Polyline This option uses the layer and color of the perimeter polyline for the solid fill faces instead of those in the dialog box.
Pick Interior Point to Make Perimeter Instead of requiring a closed perimeter polyline, this option defines the perimeter by the boundary of the area around a picked point.
Make Block of Solid The solid is created by adjoining 3D faces. This option groups the 3D faces into a block.
Select Inclusion perimeter polylines.
Select objects: *pick closed polyline*
Select Exclusion perimeter polylines.
Select objects: *press Enter*
Select Text to Exclude from fill.
Select objects: *press Enter*

Pulldown Menu Location: Edit
Keyboard Command: solidfill
Prerequisite: A closed polyline
File Name: \lsp\makegrid.arx

3D Entity to 2D

Function

This command changes a 3D Line, Arc, Circle, Polyline, Insert or Point to 2D, i.e. an entity with the elevations of the endpoints at the same Z coordinate. When the program detects a 3D polyline with all vertices with the same elevation, there is an option to convert to a 2D polyline with this elevation. Otherwise, the entered elevation here is used.

Prompts

Select/<Enter Elevation <0.00>>: *press Enter*
Select Lines, Arcs, Circles, Polylines, Inserts and Points for elevation change.
Select objects: *pick a 3D polyline*
3DPOLY to 2DPOLYLINE
Number of entities changed> 1

Pulldown Menu Location: Edit
Keyboard Command: 3dto2d
Prerequisite: None
File Name: \lsp\3dto2d.lsp

Add Points At Elevation

Function

This command inserts vertices into a 3D Polyline at a specific elevation, or elevation interval, by interpolating between existing elevations in the polyline.

Prompts

Add single elevation or elevation interval [Single/<Interval>]? *press Enter*
Enter Elevation Interval: 50
Select 3D polylines to process. *pick 3D polyline(s)*
Select objects: 1 found
Select objects:
Processing polylines ...
Added 10 points to polylines.

Pulldown Menu Location: Edit > 3D Polyline Utilities
Keyboard Command: addplz

Prerequisite: 3D Polylines
File Name: \lsp\

Select by Area

Function

This command builds a selection set using inclusion and/or exclusion closed polylines. Entities within the inclusion polylines are selected and entities within the exclusion polylines are not selected. With the Window selection method, the entity must be entirely inside the inclusion area and entirely outside the exclusion area to be included in the selection set. With the Crossing selection method, an entity is added to the selection set if any part of the entity is inside the inclusion area.

Prompts

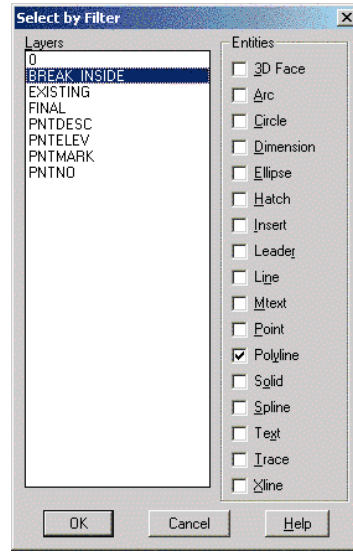
Select the Inclusion perimeter polylines or ENTER for none:
Select objects: *pick the closed polyline*
Select objects: *press Enter*
Select the Exclusion perimeter polylines or ENTER for none.
Select objects: *press Enter*
Type of selection (Window/<Crossing>)? *press Enter*
Select objects to build selection set.
Select objects: *All* These selected objects are checked with the inclusion/exclusion polylines.
Select objects: *press Enter*
Built selection set with 43 objects.
Command: *Erase*
Select objects: *P* To use previous selection set created by Select by Area.
43 found
Select objects: *press Enter*

Pulldown Menu Location: Edit > Selection Sets
Keyboard Command: ssgetarea
Prerequisite: Closed perimeter polylines
File Name: \lsp\volcalc.arx

Select by Filter

Function

This command can be used to build a selection set of objects inside a drawing based on layer and entity type. When the tool is executed it displays the following dialog. Select the layer(s) on the left you wish to select, then turn on the toggle(s) for the entity types to consider. The tool then builds a selection set of those objects that resides on those layers. When you execute your command following this selection building process, when you are prompted to select objects simply enter "P" for previous.

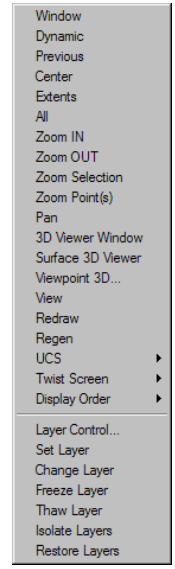


Pulldown Menu Location: Edit > Selection Sets
Keyboard Command: fsel
Prerequisite: None
File Name: \lsp\fsel.fas

View Menu

In addition to AutoCAD's powerful display and view commands, the Carlson View menu has some additional commands. The commands in the top section effect the screen display size and

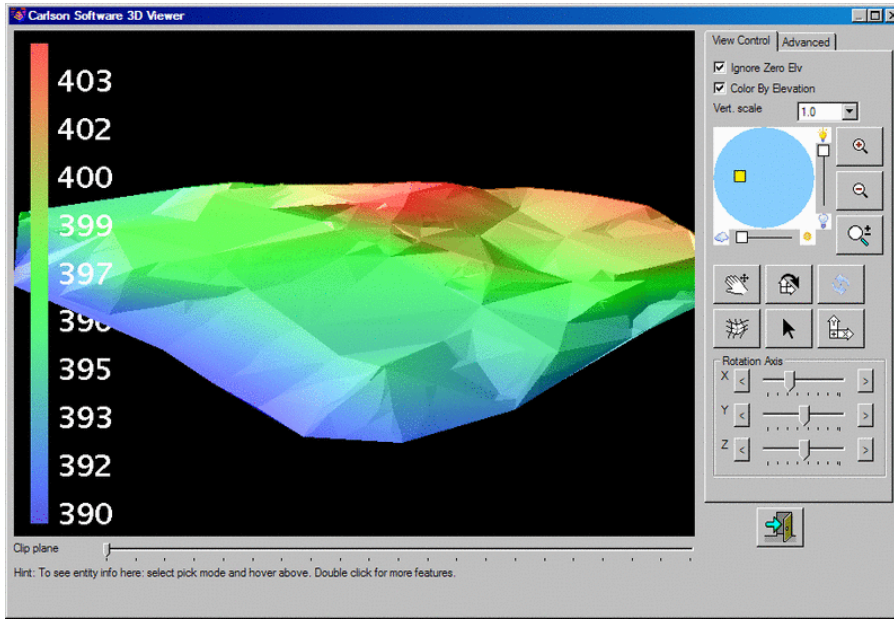
location, and the bottom section commands change layers.

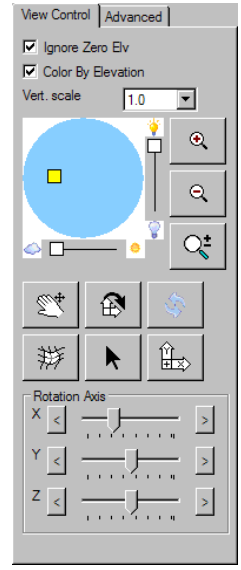


3D Viewer Window

Function

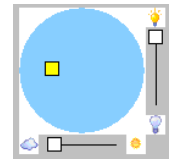
This command views in 3D, the selected 3D faces, polylines, lines and points. This routine uses the OpenGL graphics library for rendering, which gives it superior performance. Some of it's features include the ability to zoom in and out, pan, rotate around the X,Y,Z axis and shade in user-positioned lighting.





View Control

- **Ignore Zero Elevations:** When checked, the 3D viewer ignore entities at zero elevation.
- **Color By Elevation:** This will color the contours or 3D faces by elevation. The elevation scale legend is displayed on the left of the window.
- **Vert. scale:** Sets the vertical scale factor for the 3D viewer. Flat surfaces can be exaggerated by increasing the vertical scale.



This control represents position of the sun in the sky if looked from above. Therefore, the position of the sun in the center means that the sun is in a zenith, and position near the edge of the circle means that the sun is near the horizon. To move the sun, simply drag it to a new location, or click on the new location. The slide bars on the sides are the intensity and brightness of the display.

Zooms IN.

Zooms OUT.

Switch to Dynamic Zoom mode.

Switch to Pan mode. Click and drag to pan.

Switch to Rotation mode.

Switch to initial view.

Toggles shading on and off.

This is an inquire tool. Point the arrow to any entity and data such as the layer, type, elevation, length, etc will be displayed.

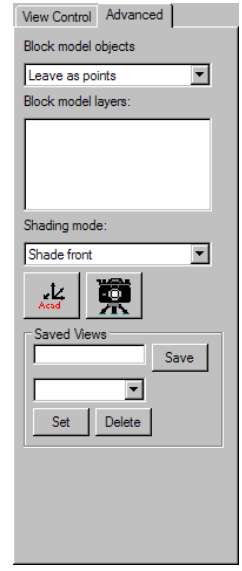
Resets the 3D view to plan.

Exit the 3D viewer window.

- **Clip Plane:** This slider will clip the image based on the location of the slider. When the slider is all the way to the left, the entire image is displayed. Moving the slider to the right

will clip the image, going deeper as the slider is moved to the right. This is useful to view items that are hidden behind something else.

- **Scroll Bars:** Use X,Y,Z scrollbars near the bottom to rotate the view. The range of these scrollbars is -180 to +180 degrees with middle being 0 which is the default position when the viewer starts. When the cursor is near the middle of the window, the XY icon will allow for rotating the image with the mouse, while holding the left mouse button. Move the cursor to the edge, and the icon switches to Z. This allows for rotating around the Z axis with the mouse, while holding the left mouse button.



Advanced Tab

- **Block Model Objects:** This option has three choices when loading block model entities. 1. To leave as points. 2. To Render and 3. To prompt each time. If render is selected, it will apply to all face objects such as a TIN or GRD.
- **Block Model layers:** This will display the block color scheme. Colors of the blocks can be turned on or off to view blocks in the middle.
- **Shading Mode:** There are 3 shading modes to render 3D faces. They are 1. Shade Front, 2. Shade Both, and 3. Shade Back. This will render the top and bottom of the faces if desired.

Export to BMP format. Displays the Export Image Selections dialog.

Sets the AutoCAD view to match the view shown in the 3D viewer window.

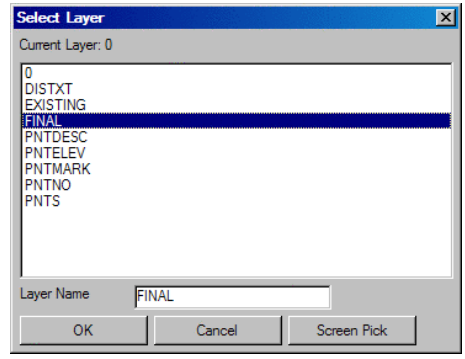
- **Saved Views:** This option allows for naming and saving a 3D view. These can be selected from the pulldown. They can be deleted from the list.

Pulldown Menu Location: View
Keyboard Command: cube
Prerequisite: Entities to display
File Name: \lsp\cube.arx

Change Layer

Function

This command allows you to change the layer of a group of entities by selecting the group of entities. The layer name to assign can be either typed it or read from an existing entity by picking an entity that is on the layer that you want to change the group to.



Prompts

Select entities to be changed.
Select objects: *pick entities*

The Select Layer dialog appears *select a layer from the list, or select Screen Pick*
If Screen Pick is chosen,
Pick entity with layer to change to: *pick another entity* This assigns the selected entities to the layer of this entity.
or
Enter new layer name or pick entity with layer (Enter/<Pick>)? *E*
Enter new layer name: *FINAL* This assigns the selected entities to the FINAL layer.

Pulldown Menu Location: View
Keyboard Command: lchg
Prerequisite: None
File Name: \lsp\chglayr.lsp

Freeze Layer

Function

This command will freeze layers by picking entities on that layer.

Pulldown Menu Location: View
Keyboard Command: loff
Prerequisite: None
File Name: \lsp\loff.lsp

Isolate Layer

Function

This command freezes all the layers except the ones you select an entity on. The program prompts to see if you would like to retain the POINT layers which keeps the Carlson point layers from freezing. By default, these layers include PNTNO, PNTMARK, PNTDESC, and PNTELEV.

Prompts

Select objects on layers to isolate.
Select objects: *pick entities*
Retain POINT layers [Yes/<No>]? *Press Enter*

Isolate the wall layer by picking one wall line

Pulldown Menu Location: View
Keyboard Command: isolate
Prerequisite: None
File Name: \lsp\isolate.lsp

Restore Due North

Function

This command twists the screen to make due north vertical.

Pulldown Menu Location: View > Twist Screen
Keyboard Command: twist4
Prerequisite: None
File Name: \lsp\surv1.lsp

Restore Layer

Function

This command thaws the layers that were frozen by the *Isolate Layer* command.

Pulldown Menu Location: View
Keyboard Command: restore
Prerequisite: None
File Name: \lsp\restore.lsp

Set Layer

Function

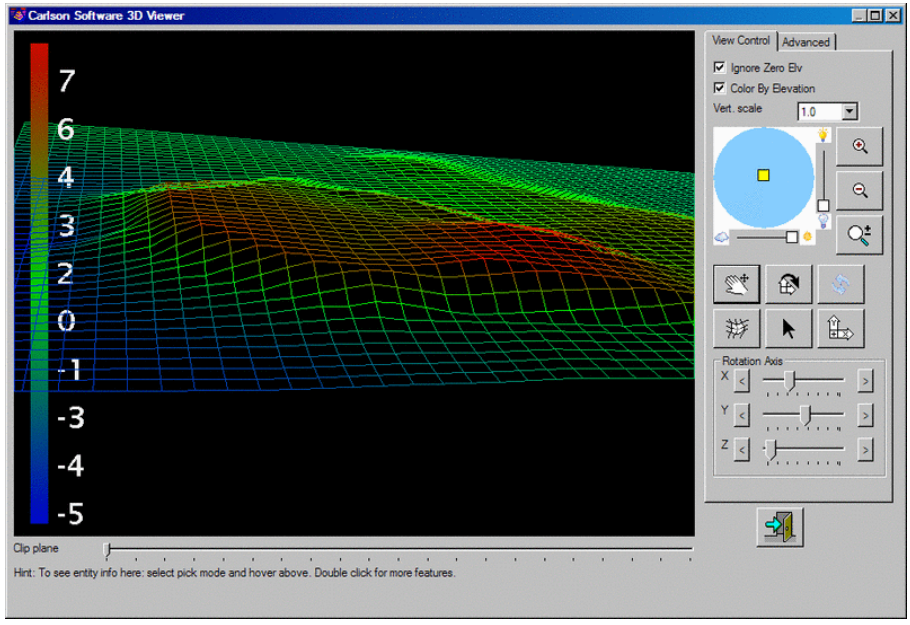
This command allows the user to change the current layer to a different layer by picking an entity on that layer.

Pulldown Menu Location: View
Keyboard Command: lset
Prerequisite: None
File Name: \lsp\picklayr.lsp

Surface 3D Viewer

Function

This command is identical to the 3D Viewer Window, except that this one loads a Carlson Grid GRD, TIN or FLT file. After the file is selected, the same viewer documented in *3D Viewer Window* appears.



Pulldown Menu Location: View
Keyboard Command: cube
Prerequisite: Entities to display
File Name: \lsp\cube.arx

Thaw Layer

Function

This command thaws the layers frozen by the Freeze Layer command.

Pulldown Menu Location: View
Keyboard Command: lon
Prerequisite: None
File Name: \lsp\lon.lsp

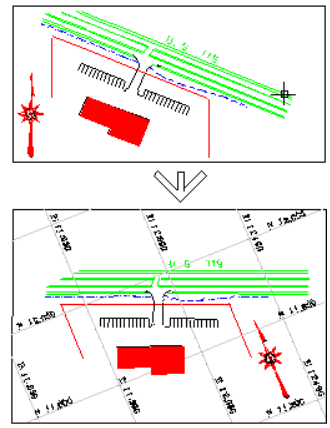
Twist Screen: Line Pline or Text

Function

This is a variation of the previous command that allows you to select a line, polyline, or text in your drawing that you want to be aligned parallel to the east-west direction of the graphics screen. Think of the entity you select as a pointer or arrow that will point in the east direction of the screen after you select it. Select the line, polyline, or text closest to the end point which you want to be the horizontal or east direction of the screen.

Prompts

Pick a line, polyline or text to make horizontal: *pick a line or polyline*



Pulldown Menu Location: View > Twist Screen
Keyboard Command: twist2
Prerequisite: None
File Name: \lsp\scadutil.arx

Twist Screen: Standard

Function

This command will twist the screen orientation to where something other than the north direction is toward the top of the screen/drawing. It does not do a coordinate rotation, the drawing coordinates remain unchanged. Use commands on the ∗Points∗ menu, such as *Rotate Points* and *Translate Points,* if you want to do a coordinate rotation or translation.

Prompts

This routine prompts for the twist angle then adjusts the screen and cross-hairs to that angle. This is a modification of AutoCAD's *DVIEW* command. The twist angle is always measured counterclockwise with 0 degrees being to the east/right.

Pulldown Menu Location: View > Twist Screen
Keyboard Command: twist1
Prerequisite: None

File Name: \lsp\surv1.lsp

Twist Screen: Surveyor

Function

This is another variation of twisting the screen that allows you to input an angle/azimuth that you want to be aligned parallel to the east-west direction of the graphics screen.

Prompts

Angle to set to horizontal: *0* This would align due north with respect to real world coordinates to the east or horizontal direction of the graphics screen.

Pulldown Menu Location: View > Twist Screen
Prerequisite: None
Keyboard Command: twist3
File Name: \lsp\scadutil.arx

Zoom Points

Function

This command centers the screen to a user-specified point. The point can be specified by either the point number or description. The command searches the current coordinate (.CRD) file. Besides centering the screen, the magnification can also be changed. The default value is the current magnification. To zoom in, enter a smaller value and to zoom out, enter a greater value.

Prompts

Find by point number or description [<Number>/Desc]? *N*
Point number or range of point numbers to find <1>: 2079
We want to find point number 2079
Magnification or Height <179.50>: *press Enter*

Accept the default zoom magnification

Pulldown Menu Location: View
Keyboard Command: zoompnt

Prerequisite: A .CRD file
File Names: \lsp\fpoint.lsp, \lsp\crdutil.arx

Zoom Selection

Function

This command zooms the display to fit the selected entities. For example, if you run *Viewpoint 3D* and your viewport only shows two small dots of entities that are far apart, then you can use *Zoom Selection* to select the entities of one of these dots and quickly zoom the display to these entities.

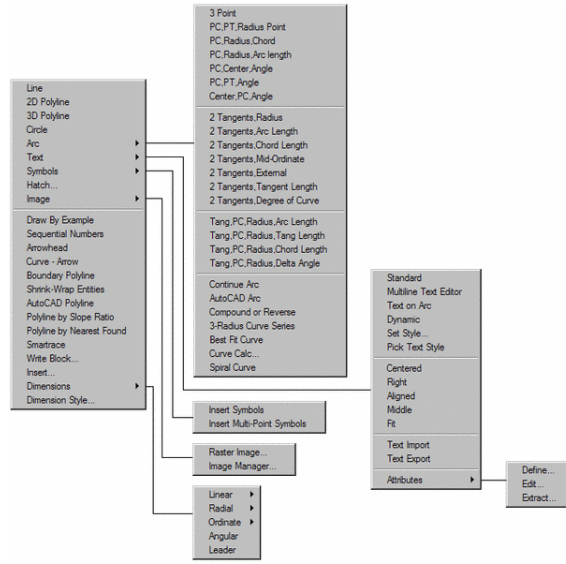
Prompts

Select objects to zoom onto:
Select objects: *select entities*

Pulldown Menu Location: View
Keyboard Command: zoom_on
Prerequisite: Entities
File Name: \lsp\mineutil.arx

Draw Menu

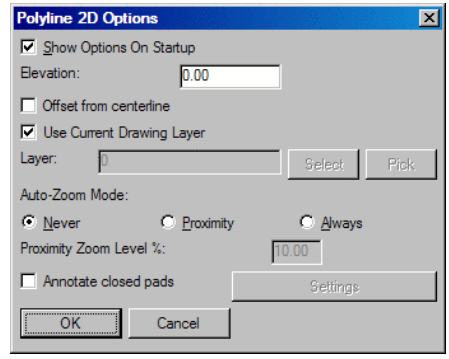
Most of the Draw Menu commands are AutoCAD commands for creating entities in your drawing. Carlson commands that are part of the Draw menu are documented here. Any items not appearing in the Carlson manual are AutoCAD commands that can be referenced in the AutoCAD manual.

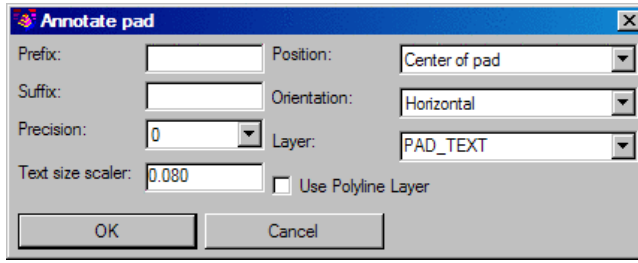


2D Polyline

Function

A polyline is a series of line and/or arc segments joined together in one entity or object. In addition to the regular AutoCAD Draw Polyline command (PL), there is this Carlson command that has several key features and options. This command allows you to draw a polyline entity in a variety of ways, including: Continue, Extend, Follow, Arc, Direction, Close, Pick point or point numbers. This dialog shown below automatically appears when you run the command.





The **Show Options on Startup** dialog will appear every time the command is run, unless this is turned off. If you do not want it to come up, then toggle it off. In this dialog you can set the elevation of the polyline, as well as the layer it will appear on.

Offset from centerline allows you to make another choice. First, a unique command line appears.

[Continue/Extend/Follow/**Offset**/Options/<Pick point or point numbers>]:

Auto-Zoom mode regenerates the screen as you draw your polyline, to give you the best view as you are working. **Always** means it will always regenerate the screen. **Proximity** regenerates the screen according to the **Proximity Zoom Level %** value. **Never** toggles off this feature. The **Elevation** of the polyline can be set here. The default is 0. If it is off, then the last settings will apply. To get the box back, choose O for Options on the command line.

If **Use Current Drawing Layer** is on, the layer of the new polyline will be the current layer. If the current layer is not used, the **Layer** option allows you to **Select** from a list or **Pick** from the screen.

There are three options under **Auto-Zoom Mode**. **Never** will not zoom to the last point picked. **Proximity** will zoom to the percent proximity set below. **Always** will always zoom center on every point.

If the **Proximity** Auto-Zoom mode is checked, the percent of the proximity is set in the box on the right.

Annotate closed pads, when checked, will make available the Settings button on the right side.

When Settings is chosen, the Annotate pad dialog appears. Here is where you can enter in values that will result in annotation for the closed polyline.

With regards the options available on the command line, they are explained as follows:

Continue allows you to run Arc, Direction, Close, Extend, or Follow for an existing polyline.

Extend allows you to extend an existing polyline by picking or entering in a distance.

Follow allows you to match the path of your polyline with an existing polyline. You are prompted to select the point in which your polyline first intersects with the existing polyline and the point in which it exits. If the existing polyline is a closed polyline than you will be prompted to approve the direction in which your polyline follows the existing closed polyline.

Options brings up the Polyline 2D Options dialog that appears when you first run the command, unless Offset from centerline is checked, in which case the letter indicates this feature, and a centerline will be requested.

Pick point allows you to pick a point on the screen to start your polyline.

Point numbers allows you to enter in coordinates to start your polyline.

Arc allows you to draw an arc by Arc length/Chord/Radius/Second point in your polyline. The + or - activates an additional prompt option that allows you to plot line segments at a 90 degree deflection angle from the last line. This is useful for plotting buildings.

Distance for an angle code, a backsight point, an angle (dd.mmss), and a distance to draw your polyline.

Close will connect the ends of your polyine making it a closed polyline.

Prompts

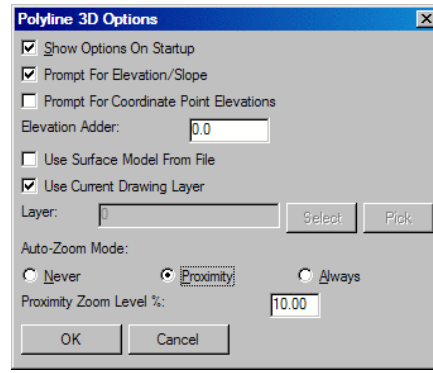
[Continue/Extend/Follow/Options/<Pick point or point numbers>]: *pick a point*
Segment length: 0.00, Total length: 0.00
[Arc/Close/Direction/Extend/Follow/Line/Undo/<Pick point or point numbers>]: *pick a point*
Segment length: 3.83, Total length: 3.83
[Arc/Close/Direction/Extend/Follow/Line/Undo/<Pick point or point numbers>]: *pick a point*
Segment length: 2.94, Total length: 6.77 *press Enter to end*

Pulldown Menu Location: Draw
Keyboard Command: 2DP
Prerequisite: None
File Names: \lsp\poly3d.arx

3D Polyline

Function

In addition to the regular AutoCAD Draw 3D Polyline command, there is this Carlson command that has several options.



The **Show Options on Startup** dialog will appear every time the command is run, unless this is turned off. If it is off, then the last settings will apply. To get the box back, choose O for Options.

Prompt for Elevation/Slope controls whether the elevation of each picked point will be entered in, or hit S for slope to draw a slope line.

Use Surface Model from File will use a grid or triangulation file as a surface model. Wherever the points are picked on the surface, the elevation of the surface will be assigned to the polyline.

If **Use Current Drawing Layer** is on, the layer of the new polyline will be the current layer.

If the current layer is not used, the **Layer** option allows you to **Select** from a list or **Pick** from the screen.

There are 3 options under **Auto-Zoom Mode.** Never will not zoom to the last point picked. Proximity will zoom to the percent proximity set below. Always will always zoom center on

every point.

If the Proximity Auto-Zoom mode is checked, the percent of the proximity is set in the **Proximity Zoom Level%** box.

Prompts

[Continue/Extend/Follow/Options/<Pick point or point numbers>]: *pick a point*
Elevation <0.00>: *435*
Z: 435.00, Hz dist: 0.00, Slope dist: 0.00, Slope: 0.0% Ratio: 0.0:1
[Arc/Direction/Close/Follow/Undo/<Pick point or point numbers>]: *pick a point*
Slope/Ratio/Interpolate/Degree/<Elevation> <0.00>: *444*
Z: 444.00, Hz dist: 3.67, Slope dist: 9.72, Slope: 245.3% Ratio: 0.4:1
[Arc/Direction/Close/Extend/Follow/Undo/<Pick point or point numbers>]: *pick a point*
Slope/Ratio/Interpolate/Degree/<Elevation> <0.00>: *399*
Z: 399.00, Hz dist: 3.16, Slope dist: 45.11, Slope: -1425.2% Ratio: -0.1:1
[Arc/Direction/Close/Extend/Follow/Undo/<Pick point or point numbers>]: *press Enter to end*

Pulldown Menu Location: Draw
Keyboard Command: 3DP
Prerequisite: None

3 Point

Function

This command draws an arc between three points. The first point is the PC, the second is a point on the arc and the third is the PT. The points can either by picked on-screen or specified by point number.

Prompts

Pick PC point or point numbers: *101* (For point number 101.)
Pick Second point or point number: *102*
Pick PT point or point number: *103*

Pulldown Menu Location: Draw > Arc
Keyboard Command: 3PA
Prerequisite: None
File Name: \lsp\3ptarc.lsp

PC, PT, Radius Point

Function

This command draws an arc between the PC point, radius point and PT point. The points can either by picked on-screen or specified by point number. Given these points, the arc can be drawn clockwise or counterclockwise. The program shows one direction and asks if it is correct. If you need the arc to go the other direction, enter No.

Prompts

Pick PC point or point number: *101*
Pick Radius point or point number: *102*
Pick PT point or point number: *103*
Is the direction of this arc correct ? No/<Yes>: *N*

Pulldown Menu Location: Draw > Arc
Keyboard Command: pca
Prerequisite: None

PC, Radius, Chord

Function

This command draws an arc, given the PC point, radius length, chord length and chord bearing. The PC point can either by picked on-screen or specified by point number. Given these points, the arc can be drawn clockwise or counter-clockwise. The program shows one direction and asks if it is correct. If you need the arc to go the other direction, enter No.

Prompts

Radius of Arc <-40.00>: *500*
PC Start Point ?

Pick point or point number: *pick a point*
Chord bearing or chord endpoint (<Bearing>/Point)? *Press Enter*
Enter Bearing (Qdd.mmss) <90.0000>: *145.1041* (for NE 45d10'41")
Chord Length <200.46>: 200
Is this arc in the correct direction (<Yes>/No)? *Press Enter*

Pulldown Menu Location: Draw > Arc
Keyboard Command: srcb
Prerequisite: None

PC, Radius, Arc Length

Function

This command draws an arc given the PC point, radius length, and arc length. The PC point can either by picked on-screen or specified by point number. Given these points, the arc can be drawn clockwise or counterclockwise. The program shows one direction and asks if it is correct. If you need the arc to go the other direction, enter No.

Prompts

Pick PC Point or point number: *pick a point*
Pick Radius point or point number: *pick a point*
Arc length <5.00): *150*
Is this arc in the correct direction (<Yes>/No)? *press Enter*

Pulldown Menu Location: Draw > Arc
Keyboard Command: pra
Prerequisite: None
File Name: \lsp\cenarc.lsp

2 Tangents, Radius

Function

This command fits a curve between two tangent lines by entering a known radius. It prompts for the radius and then prompts to pick points on the two tangent lines.

Prompts

Radius of Arc <300.000>: *press Enter*
[nea] Pick Point on 1st Tangent Line:*pick a point*
[nea] Pick Point on 2nd Tangent Line: *pick a point*

Pulldown Menu Location: Draw > Arc
Keyboard Command: 2tanlin
Prerequisite: Tangent lines should be drawn before execution
File Name: \lsp\2tanlin.lsp

2 Tangents, Arc Length

Function

This command fits a curve between two tangent lines and a known arc length. It prompts for the arc length then pick the P.I. (intersection of tangent lines) and points on the two tangent lines.

Prompts

Arc Length <100.00>: *press Enter or enter distance*
[int on] Pick P.I. of curve: *pick intersection of tangent lines*
[nea on] Pick pnt on 1st Tangent Line: *pick a point*
[nea on] Pick pnt on 2nd Tangent Line: *pick a point*

Pulldown Menu Location: Draw > Arc
Keyboard Command: 2tanlal
Prerequisite: Tangent lines should be drawn before execution
File Name: \lsp\2tanlal.lsp

2 Tangents, Chord Length

Function

This command fits a curve between two tangent lines and a known chord length. It prompts for the chord length, the P.I. and points on the two tangent lines.

Prompts

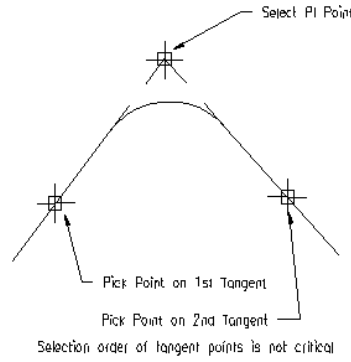
Chord Length <100.00>: *press Enter*
[int on] Pick P.I. of curve: *pick a point*
[nea on] Pick Point on 1st Tangent Line: *pick a point*
[nea on] Pick Point on 2nd Tangent Line: *pick a point*

Pulldown Menu Location: Draw > Arc
Keyboard Command: 2tanlcl
Prerequisite: Tangent lines should be drawn before execution
File Name: \lsp\2tanlcl.lsp

2 Tangents, Mid-Ordinate

Function

This command fits a curve between two tangent lines and a known middle ordinate. It prompts for the middle ordinate length, the Point of Intersection and points on the two tangent lines.



Prompts

Middle Ordinate <50.00>:*press Enter*
[int on] Pick P.I. of curve: *pick a point*
[nea on] Pick Point on 1st Tangent Line: *pick a point*
[nea on] Pick Point on 2nd Tangent Line: *pick a point*

Pulldown Menu Location: Draw > Arc
Keyboard Command: 2tanlmo

Prerequisite: Tangent lines should be drawn before execution
File Name: \lsp\2tanlmo.lsp

2 Tangents, External

Function

This command fits a curve between two tangent lines and a known external secant distance. It prompts for the P.I. and points on the two tangent lines then the external distance.

Prompts

[int on] Pick P.I. of curve: *pick a point*
[nea on] Pick Point on 1st Tangent Line: *pick a point*
[nea on] Pick Point on 2nd Tangent Line: *pick a point*
External Distance <50.00>: *press Enter*

Pulldown Menu Location: Draw > Arc
Keyboard Command: 2tanlex
Prerequisite: Tangent lines should be drawn before execution
File Name: \lsp\2tanlex.lsp

2 Tangents, Tangent Length

Function

This command fits a curve between two tangent lines and a known curve tangent length. It prompts for the tangent length, P.I. and points on the two tangent lines.

Prompts

Tangent Length <50.00>:*press Enter*
[int on] Pick P.I. of curve: *pick a point*
[nea on] Pick Point on 1st Tangent Line: *pick a point*
[nea on] Pick Point on 2nd Tangent Line: *pick a point*

Pulldown Menu Location: Draw > Arc
Keyboard Command: 2tanltl

Prerequisite: Tangent lines should be drawn before execution
File Name: \lsp\2tanltl.lsp

2 Tangents, Degree of Curve

Function

This command fits a curve between two tangent lines by entering a known degree of curve. It prompts for the degree of curve and then prompts to pick points on the two tangent lines.

Prompts

Degree of Curve (ddd.mmss) <5.0000>: *press Enter*
Define by [C]hord or [A]rc length <A>: *press Enter*
[nea on] Pick Point on 1st Tangent Line: *pick a point*
[nea on] Pick Point on 2nd Tangent Line: *pick a point*

Pulldown Menu Location: Draw > Arc
Keyboard Command: 2tanldo
Prerequisite: Tangent lines should be drawn before execution
File Name: \lsp\2tanldo.lsp

Tangent, PC, Radius, Arc Length

Function

This command draws a curve from a perpendicular tangent line with a known radius and arc length. It prompts for the radius, the arc length and then to pick the P.C. start point of the curve (endpoint of previously drawn tangent line) and a point along the tangent line.

Prompts

Precede radius with - sign for curve to the right.
Radius of Arc <15.00>: *55*
Arc Length <25.00>: *30*
PC Start Point ?
Pick point/<point Number>: *14*
PtNo. North(y) East(x) Elev(z) Desc
14 4869.06 4390.3 10.00

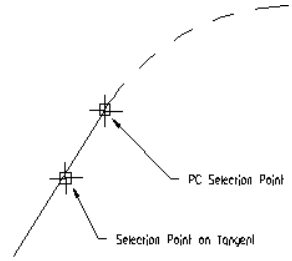
[nea on] Pick point along perpendicular tangent line: *pick a point on tangent line*
Radius Point Coordinates: (4355.2 4911.4 0.0)

Pulldown Menu Location: Draw > Arc
Keyboard Command: sral
Prerequisite: Tangent lines should be drawn before execution
File Name: \lsp\sral.lsp

Tangent, PC, Radius, Tangent Length

Function

This command draws a curve from a perpendicular tangent line with a known radius and tangent length. It prompts for the radius, the tangent length and then to pick the P.C. start point of the curve and a point along the tangent line.



Prompts

Precede radius with - sign for curve to the right.
Radius of Arc <300.0000>: *press Enter*
Tangent Length <236.0000>: *press Enter*
PC Start Point ?
Pick point or point number: *pick a point*
[nea on] Pick point along perpendicular tangent line: *pick a point*
(5270.39 4840.36 0.0)
Radius Point Coordinates: (5251.37 4534.71 0.0)

Pulldown Menu Location: Draw > Arc
Keyboard Command: srtl

Prerequisite: Tangent lines should be drawn before execution
File Name: \lsp\srtl.lsp

Tang, PC, Radius, Chord Length

Function

This command draws a curve from a perpendicular tangent line with a known radius and chord length. It prompts for the radius, the chord length and then to pick the P.C. start point of the curve and a point along the tangent line.

Prompts

Precede radius with - sign for curve to the right.
Radius of Arc <300.0000>: *press Enter*
Chord Length <25.0000>: *press Enter*
PC Start Point ?
Pick point or point number: *pick a point*
[nea on] Pick point along perpendicular tangent line: *pick a point*
(5142.38 4911.57 0.0)
Radius Point Coordinates: (5221.51 5209.63 0.0)

Pulldown Menu Location: Draw > Arc
Keyboard Command: SRCL
Prerequisite: Tangent lines should be drawn before execution
File Name: \lsp\srcl.lsp

Tang, PC, Radius, Delta Angle

Function

This command draws a curve from a perpendicular tangent line with a known radius and delta angle. It prompts for the radius, the delta angle and then to pick the P.C. start point of the curve and a point along the tangent line.

Prompts

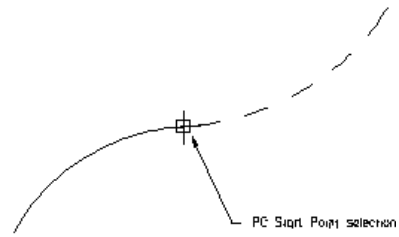
Precede radius with - sign for curve to the right.
Radius of Arc <300.00>: *press Enter*
Enter Delta Angle <90.00>: *press Enter*
PC Start Point ?
Number/<Pick point>: *pick a point*
[nea on] Pick point along perpendicular tangent line: *pick a point*

Pulldown Menu Location: Draw > Arc
Keyboard Command: srda
Prerequisite: Tangent lines should be drawn before execution
File Name: \lsp\srda.lsp

Compound or Reverse

Function

This command draws a compound or reverse off an existing curve. It prompts whether the curve is reverse or compound, for the P.C. start point (endpoint of an existing arc) and the known radius. Then the user selects the other known from the choices of tangent length, arc length, chord length or delta angle and enters that value. This command can be confused and malfunction if there is another entity such as a point symbol at the P.C. (If this happens, freeze the PNTMARK layer or temporarily erase the point symbol.)



Reverse curve off an existing curve

Prompts

[end on] Select ARC at PC Start point of the curve: *pick a point*
Type of curve [<Compound>/Reverse]: *press Enter*
Enter the Radius: *300*
Define arc method [Tangent/Chord/Delta/<Length>]: *press Enter*

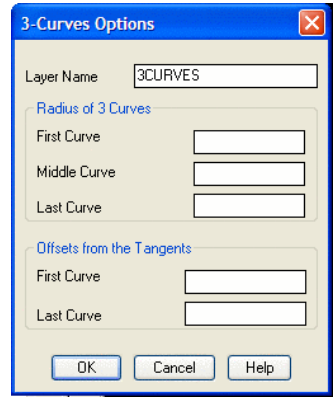
Enter the arc length: *236*

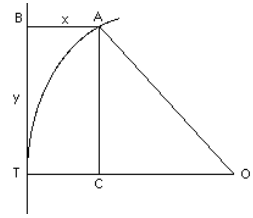
Pulldown Menu Location: Draw > Arc
Keyboard Command: srcr
Prerequisite: Tangent arc should be drawn before execution
File Name: \lsp\srcr.lsp

3-Radius Curve Series

Function

This command is used to best fit a series of three curves with different radii between 2 tangents. The "Offsets from the Tangents" is the distance perpendicular to the tangent from both ends of the second curve.





Offset from the tangents is the x value

Prompts

Please pick two tangents...
Pick first tangent: *pick a point*
Pick second tangent: *pick a point*

Pulldown Menu Location: Draw > Arc
Keyboard Command: 3curves
Prerequisite: Two tangents

Best Fit Curve

Function

This command draws an arc between to endpoints with a radius that is derived from sampling points and averaging the radius of an arc that passes though these points.

Prompts

Starting Point ?
Pick point or point number: *pick a point*
Ending point ?
Pick point or point number: *pick a point*
Select points from screen or by point number [<Screen>/Number]: *press Enter*
Select Points to sample.
Select objects: *W* Use window to select a group of points. After selecting all the points to sample, end selection by pressing Enter.

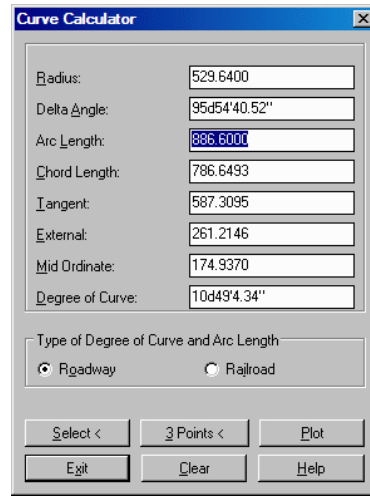
Pulldown Menu Location: Draw > Arc
Keyboard Command: bfitcrv
Prerequisite: Points for sampling should be drawn before execution.
File Name: \lsp\bfitcrv.lsp

Curve Calc

Function

This Curve Calculator command displays a dialog box with a series of edit boxes that are filled in with the values of a curve. You can input two known values and the program calculates the other values. One of the known values must be the radius or the delta angle. The 3 Points option allows you to simply select three on-screen point locations. All of the fields will immediately be

filled in after the picking of the third point. Optionally, you can also input point numbers from a coordinate file.



Roadway or Railroad: Allows you to choose which type of curve you would like information on. Toggling between the two, after data is entered, will reveal different values.
Select: Allows you to select an arc from the drawing. The information for the selected arc is displayed in the dialog box.
3 Points: Allows you to specify three points on the screen to define an arc. The information for this defined arc is displayed in the dialog box.
Plot: Allows you to plot the currently defined arc in the drawing.
Clear: Clears all edit boxes in the dialog.

Prompts

Curve Calculator dialog *Enter at least two values, as described above*
The dialog box first pops up without any data in the fields. The above dialog graphic is a result of entering in the radius and the arc length values of a known curve, then the *Enter* or *Tab* key.

Pulldown Menu Location: Draw > Arc
Keyboard Command: curvcalc
Prerequisite: None
File Names: \lsp\curvcalc.lsp, \lsp\scadcfu.dcl

Spiral Curve

Function

This command plots a spiral curve. The user must provide the P.I. (point of intersection), the length of spiral and the radius length of the simple curve. The command will plot a symmetrical spiral or a spiral in or spiral out (choose the S option for the first prompt if you only want to plot a spiral out). If you have an unsymmetrical spiral then plot a spiral in using the T or P option then use the S option to plot the spiral out. The command plots a polyline to represent the spiral as line segments at the resolution specified by the user. You can use the *Calculate Offsets*, *Station Polyline/Centerline* or *Offset Point Entry* commands, found in the Centerline menu, to calculate points and/or stations and offsets from the spiral.

Prompts

Spiral method [TS/ST/<PI>] *press Enter*
PI Point ?
Pick point or point number: *pick intersection of tangent lines*
TS Direction point (tangent in) ?
Pick point or point number: *pick point along tangent in line*
ST Direction point (tangent out) ?
Pick point or point number: *pick point along tangent out line*
Tangent in direction= N 56d24'9" E Azimuth= 56d24'9"
Tangent out direction= S 65d9'1" E Azimuth= 114d50'59"
Overall Delta= 58d26'50"
Point calculating distance resolution <10.0>: *press Enter*
Length of Spiral <350.0>: *press Enter*
Radius of simple curve (precede with - sign if curve to left) <954.93>: *954.93*
Degree of curve: 6d0'0"
Theta of Spiral= 0.18325951 (radians) 10d30'0" (dd.mmss)
Distance along tangent line from TS to SC= 348.82
Distance offset from tangent line to SC= 21.33
(k) Shift along tangent line of PC= 174.80
(p) Shift offset from tangent line of PC= 5.34
Distance from PI to TS= 712.00
North(Y) of TS= 4583.08 East(X) of TS= 4244.46
North(Y) of SC= 4758.34 East(X) of SC= 4546.82
North(Y) of Offset PC= 4675.36 East(X) of Offset PC= 4393.02
[P]lot spiral or

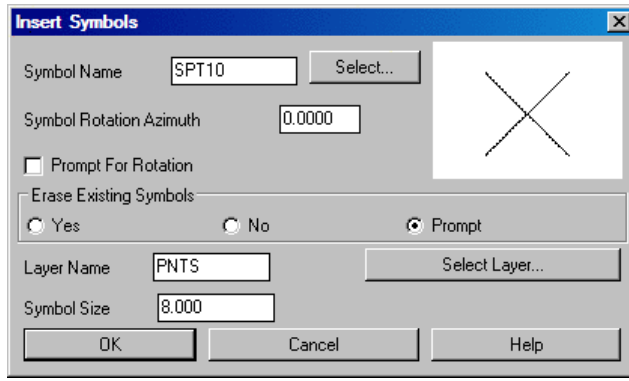
[I]ntermediate distances for staking (deflection angle calc) <P>: *press Enter*
Point calculating distance resolution <10.0>: *5* Enter the resolution at which you would like the line segments of the representative polyline plotted.
North(Y) of Radius Pt= 3879.96 East(X) of Radius Pt= 4921.44
<press [Enter] for symmetrical spiral out>/[D]elta of simple curve: *press Enter* If you want a spiral in only enter D then input the delta angle of the curve.
Simple Curve Delta= 37d26'50" Length of Arc= 624.12
North(Y) of CS= 4805.10 East(X) of CS= 5158.11

Pulldown Menu Location: Draw > Arc
Keyboard Command: spiral
Prerequisite: For a symmetrical spiral, draw the tangent in and tangent out lines. For spiral in or out only, draw the tangent line in or out.
File Name: \lsp\spiral.lsp

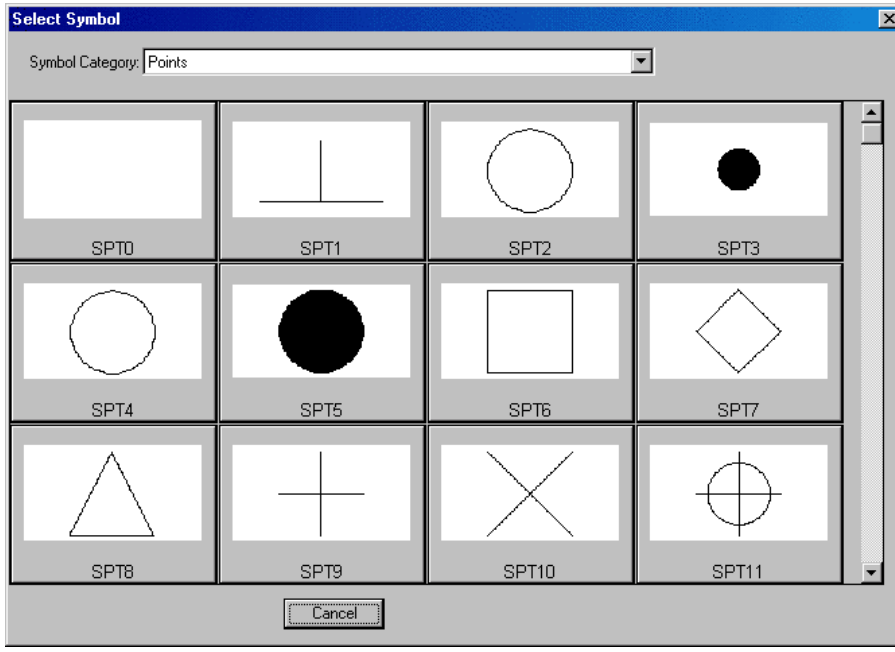
Insert Symbols

Function

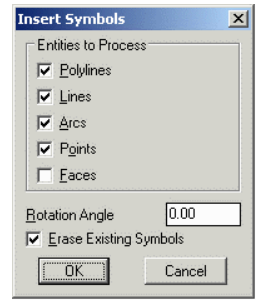
This command inserts symbols from the symbol library into the drawing. The symbol library may be edited using the *Edit Symbol Library* command. The locations for the symbols can be specified by picking points, specifying point numbers in the current coordinate (.CRD) file or by entering the northing and easting. If you specify a point number, and that point number already has a symbol on it, you will be prompted whether or not to replace the existing symbol. Selecting the Enter coords option allows you to insert the symbol by entering a northing, easting and elevation. Using the Select entities option, symbols can also be placed on arcs, faces, points, text, lines and polylines. Under the Options command, you can turn prompting for rotation on or off. With rotation off, the symbol will be inserted horizontal to the current twist screen. Choose a symbol from the Select Symbol dialog by clicking on it. The Symbol Category choices are Points, Trees and Map Symbols. You may select a category by choosing the Symbol Category dropdown list. Within each category, use the scroll bar to view all of the symbols.



Appears at start of command



Appears when Select (symbol) is chosen



Select entities dialog box

Prompts

Insert Symbols dialog *choose variables and click OK*
Options/Select entities/Enter coords/<Pick point or point numbers>: *pick a point*
Options/Select entities/Enter coords/<Pick point or point numbers>: *5-10* Inserts symbols at points 5-10 from the current coordinate file.
Options/Select entities/Enter coords/<Pick point or point numbers>: *S*
Insert Symbols dialog
Select arcs, faces, points, text, lines and polylines. *select objects*
Options/Select entities/Enter coords/<Pick point or point numbers>: *press Enter to end*

Pulldown Menu Location: Draw > Symbols
Keyboard Command: ptsym
Prerequisite: None
File Name: \lsp\lptsym.lsp

Insert Multi-Point Symbols

Function

This command allows you to locate symbols using multiple insertion points. Up to three insertion points can be defined for an individual symbol. When defining only two insertion points for a particular symbol, the symbol will be scaled and rotated. With three insertion points defined, the symbol is rotated and scaled in both the X and Y directions. The two point insertion definition will aid in the drawing of tree symbols with a specific drip line width. For instance, a surveyor could locate the tree and then locate the drip line, two shots for each tree, and allow the program to size the tree symbol accordingly so that the map will have various tree symbol sizes that reflect the actual field conditions.

The multiple insertion points are defined in the Field to Finish codes. The *Insert Multi-Point Symbols* command reads the Field to Finish code table and finds all of the codes with multi-point symbol definitions. Then you can select from these codes for the symbol to draw. Both the two and three point insertion definitions can aid with the insertion of concretes and buildings symbols during final drawing preparations and design phases of a project.

Here are the various steps to define two point and three point insertion point symbols. First, you must decide on the symbol to use for the desired code, as well as the specific placement points for the symbol. Once a symbol has been chosen, open the desired symbol drawing. To do this, identify the symbol name and then locate the symbol by its drawing name under the SUP sub-directory found under the Carlson installation directory. Next, determine the placement points for the symbol. As shown below, the placement points for the BLD code symbol, which will be explored later in this section, were determined by identifying X and Y values of the desired placement points by using the id command and specifying the end points of the lines.

Next, the symbol insertion points must be defined in the Field to Finish code table (.FLD) file. To do this, open your FLD file by choosing *Draw Field to Finish* under the Survey pulldown. Then select a particular code from the list of codes displayed in the Field to Finish dialog box. Edit it by highlighting the code and picking the Edit button, or define a new code with the Add button. Either choice will display the Edit Field Code Definition dialog. In the Edit Code Definition dialog, choose the desired symbol for the code by pressing the Set Symbol button and selecting the desired symbol. Next, select the Symbol Pts button. This brings up a dialog called Define Symbol Placement Points. Here is where you define the symbol by three points. You do this by entering an X and Y coordinate and a description for the symbol. Enter the X and Y values for each placement point into the appropriate fields. The description fields are used as the prompts when placing the symbol in the drawing. A two insertion point symbol is defined in the same way. An example is the Symbol Pnts definition for the code TREE. The placement points for the Tree code symbol were determined by opening the symbol drawing and finding the X and Y values at the insertion points. The center of the large circle was chosen for Point 1 and the East Quadrant was chosen for point 2. In both cases osnaps were used in picking the points.

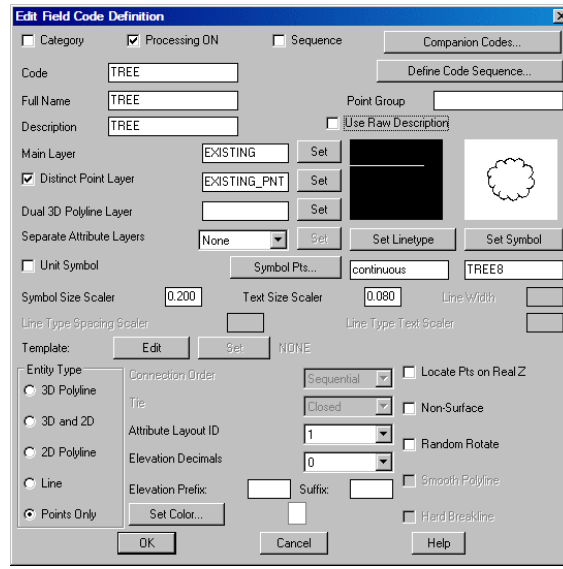
Now that we have the codes defined, lets go through the *Insert Multi-Point Symbol* command and see the results. The command starts with a dialog that lists all the codes with Multi-Point Symbols defined. At this point you can select the symbol to draw. The symbol size applies only to using one point to place the symbol. When two or more points are used, the symbol is scaled to fit the points. Lets look at the BLD code three point insertion definition. Shown below are three points that represent a building pad. We want the building to be exactly the same dimensions defined by the point locations.

The three point PAD and the tree with drip line examples follow. We start by specifying the building pad codes.

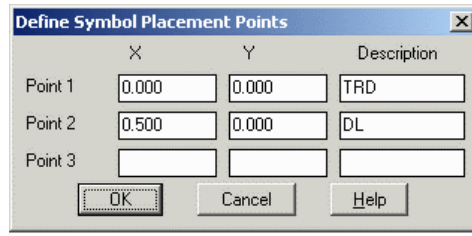
Prompts

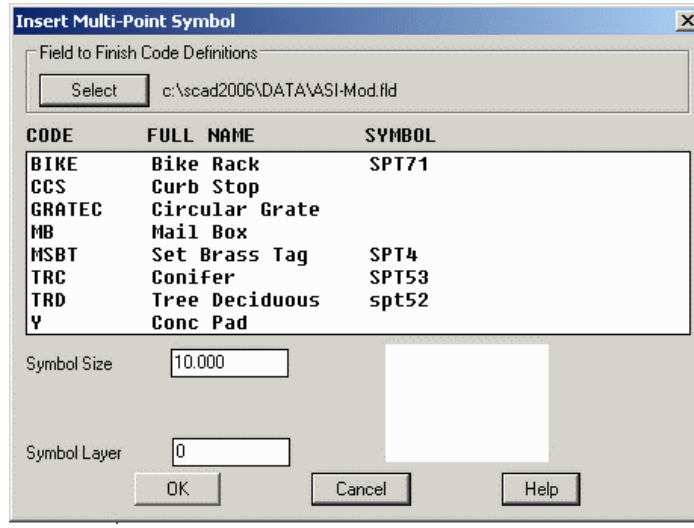
Insert Multi-Point Symbol Dialog
Choose a symbol to draw. In this example, the Pad symbol is a 3 point multi-symbol.
Specify LTFNT PAD point.
Pick Point or Point Number (Enter to End): *15*
Specify LT REAR PAD point.
Pick Point or Point Number (Enter to End): *16*
Specify RT REAR PAD point.
Pick Point or Point Number (Enter to End): *17*
Insert another BLD symbol [<Yes>/No]? *N*

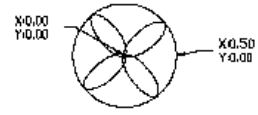
Insert Multi-Point Symbol Dialog
Choose a symbol to draw. In this next example, the Tree symbol is a 2 point multi-symbol. Now specify the location of the trunk and the drip line by point number.
Specify Trunk Location point.
Pick Point or Point Number (Enter to End): *1*
Specify Drip Line Point.
Pick Point or Point Number (Enter to End): *13*
Insert another TREE symbol [<Yes>/No]? *N*



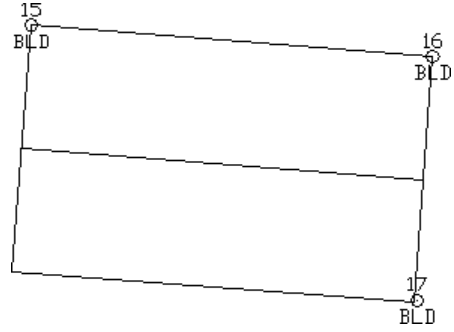
From the Field to Finish routine



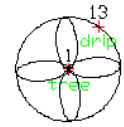




Two points symbol placement for TREE



Three points for building PAD



Two point tree with drip line

Pulldown Menu Location: Draw > Symbols
Keyboard Command: multsym
Prerequisite: Field to Finish file (.FLD) with codes defined with Multi-Point Symbols
File Name: \lsp\finish.arx

Draw By Example

Function

This command prompts you to pick an entity and then starts the appropriate draw command to begin creating another one of the selected type of entity. The properties such as layer and color of the original entity are used for creating the new one. For example, if you pick a polyline, this command will start the *Pline* command. Likewise if you pick text, this command will begin the *Text* command using the layer and style of the selected text.

Prompts

Pick Object for Command: *pick an entity*
The remaining prompts depend on the type of the selected entity.

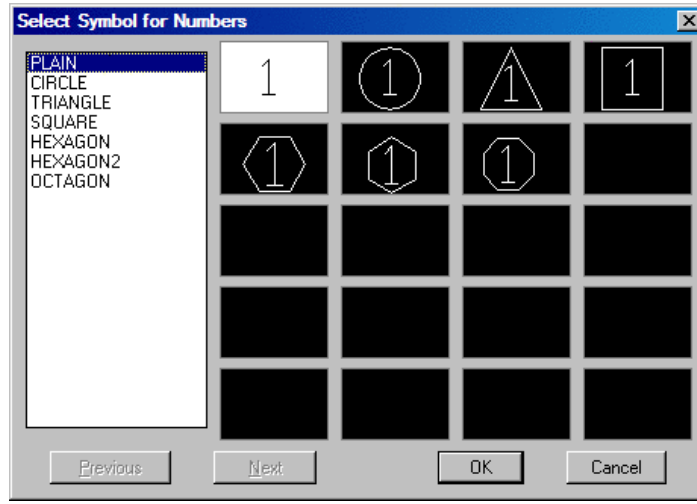
Pulldown Menu Location: Draw
Keyboard Command: drawbyex
Prerequisite: Entities
File Name: \lsp\drawbyex.lsp

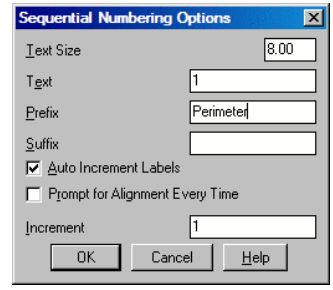
Sequential Numbers

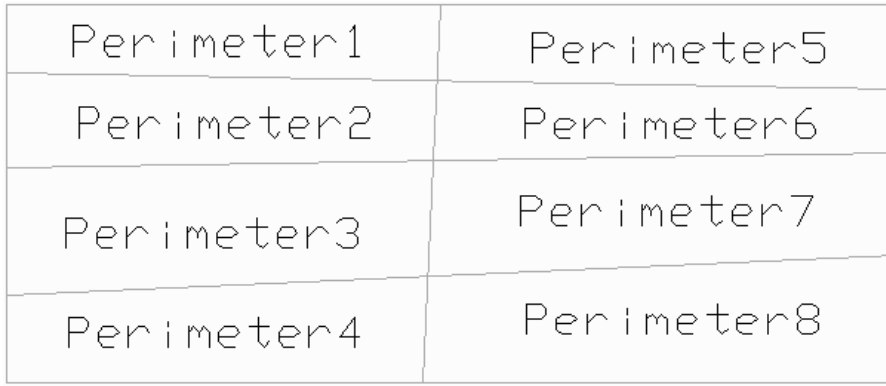
Function

This command draws a text label and then increments to the next value for additional labels. The label and optionally be placed inside a circle, square or other symbol. The size of the symbol

adjusts to fit the label size. First, pick one of the seven formats.







Specify the **Text Size** (height). Defaults to size set in *Drawing Setup.*
Specify the **Text** label.
Specify an optional text **Prefix**.
Specify an optional text **Suffix**.
When **Auto Increment Labels** is checked, the value entered in the Text field will be incremented by the value in the Increment field.
When **Prompt for Alignment Every Time** is checked, you will be prompted for the alignment angle for each label, otherwise the alignment from the first label is automatically used for the other labels.
If Auto Increment Labels is checked, Text value is incremented by the **Increment** value.

The label is drawn by combining the Prefix, Text and then Suffix into one text label. When placing multiple labels, the text portion of the label will increment by the value in the Increment field. For example, this command could be used to quickly label a series of boundaries by setting the Prefix to "Perimeter" and the Text field to the starting number. Then pick points inside the boundaries to label as "Perimeter 1", "Perimeter 2", etc.

Prompts

Select Symbol for Numbers dialog *select your symbol*
Sequential Numbering Options dialog *make your choices*
Pick point at beginning of label: *pick a point*
Pick point for label alignment: *pick a point to the right of the first point*
Pick point at beginning of label: *press Enter to end the routine*

Pulldown Menu Location: Draw
Keyboard Command: numbers
Prerequisite: None

File Name: \lsp\cir_num.lsp

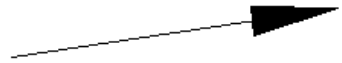
Arrowhead

Function

This command draws an arrowhead at the end of the selected line or polyline.

Prompts

Enter the arrow size <5.00>: *press Enter*
Pick a line or pline to add arrow: *pick a line or polyline*
Pick a line or pline to add arrow (Enter to End): *press Enter*



Pulldown Menu Location: Draw
Keyboard Command: arrowhd
Prerequisite: None
File Name: \lsp\scadutil.arx

Curve - Arrow

Function

Curve - Arrow can be used to draw a section of contour line or create leader pointer lines. Curve - Arrow draws a Bezier curve through user specified points. After choosing endpoints, each time an intermediate points is picked the curve will be redrawn through all the points. There is an option to draw an arrowhead at the starting point. The arrowhead size is determined by the AutoCAD system variable "DIMASZ". In order to change this size, type DIMASZ at the AutoCAD command prompt. This routine also has a Zorro option which creates a Z leader curve.

Prompts

Create a Zorro (Yes/<No>)? *N*
Include an arrow (Yes/<No>)? *Y*
Enter the arrow head size <4.00>: *press Enter* This defaults to the DIMASZ system variable.
Pick a starting point: *pick a point*

Pick an ending point: *pick a point*
Pick an intermediate point (U to Undo): *pick a point*
Pick an intermediate point (U to Undo): *press Enter*

Examples of Curve - Arrow

Pulldown Menu Location: Draw
Keyboard Command: carrow
Prerequisite: None
File Names: \lsp\cir_num.lsp, \lsp\scadutil.arx

Boundary Polyline

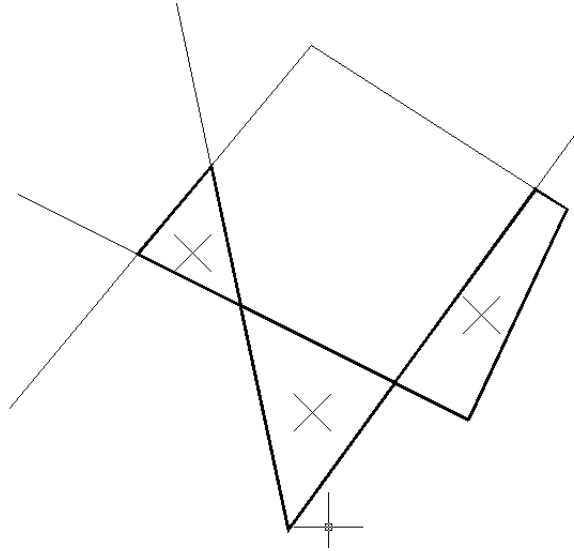
Function

This is a streamlined analog of the AutoCAD command *Boundary.* The Carlson version is faster and works in many cases where *Boundary* fails. *Boundary Polyline* supports a snap tolerance, which means that you may specify a maximum gap to close when creating a closed polyline.

To create closed polylines from any existing linework, simply select all entities you would like to use and specify desired snap tolerance. Then click inside openings you would like to trace and the routine will generate corresponding closed polylines. The duplicate polylines are detected and not created, so that clicking more than once in the same area does not change anything. These new polylines are always created in the current layer. Layers of the original linework do not matter.

Prompts

Select polylines: *pick an entities to be used*
Enter snap tolerance or press Enter for none:
Pick an internal point: *pick the points to enclose*



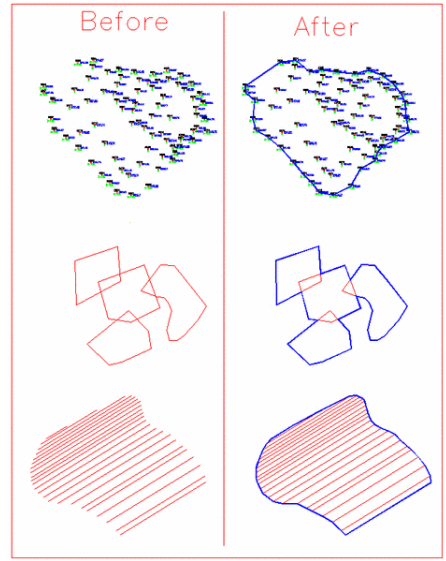
These three polylines are created from original linework by clicking at shown locations

Pulldown Menu Location: Draw
Keyboard Command: boundpl
Prerequisite: Entities
File Names: \lsp\scbpoly.arx

Shrink-Wrap Entities

Function

This command creates a closed polyline which encloses a given set of entities. The resulting polyline is created in the current layer. The program works on either point entities or polylines. For points, the program creates a closed polyline through the points around the perimeter of the area defined by the points. For polylines, the shrink-wrap polyline follows the outside border of the selected polylines. The polylines that are processed have to be connected to be shrink-wrapped. The snap tolerance is the maximum gap that will be joined to make the closed polyline. For open polylines, as in the bottom figure, the Gap method works better, as it jumps across the gaps and connects the end points.



Prompts

Shrink-wrap across gaps or bounded linework only [<Gap>/Bound]? *G*
Shrink-wrap layer <FINAL>:
Select points and linework to shrink-wrap.
Select objects: *select entities to process*
Reading points... 46
Inserted 46 points.
Inserted 23 breakline segments
Perimeter reduction level 0-3 (0-None, 3-Most) <2>: *2*
Reduce Perimeter Pass: 1 Removed: 5
Reduce Perimeter Pass: 2 Removed: 3
Reduce Perimeter Pass: 3 Removed: 4
Reduce Perimeter Pass: 4 Removed: 2
Reduce Perimeter Pass: 5 Removed: 1
Reduce Perimeter Pass: 6 Removed: 0
Create 2D or 3D Polyline [<2D>/3D]? *2D*

Pulldown Menu Location: Draw
Keyboard Command: swplines
Prerequisite: Entities

File Name: \lsp\scbpoly.arx

Polyline by Slope Ratio

Function

This command allows you to draw or revise a polyline by specifying distance and slope ratio, percent of grade or pick points on the screen. The polyline could represent a section or profile which can be processed with the *Polylines End Area* or *Sections from Polyline.*

Prompts

Horizontal scale <50.0>: *20*
Vertical scale <50.0>: *10*
Pick point/<Starting elevation of polyline-section <100.0>>: *P* Enter the starting elevation or press Enter to use the default value in brackets and you are prompted for the starting offset or X coordinate. By entering P you are prompted to pick a starting point for the polyline/section.
Pick start point: *pick a point*
Slope ratio + for up slope - for down slope.
Undo/End/switch to Left/Pick point/<Enter Right Distance>: *130*
End/Percent slope/<Slope Ratio (?:1) <2.0>>: *5* This enters a slope ratio of 5 to 1 for 130 feet to the right of the starting point.
Undo/End/switch to Left/Pick point/<Enter Right Distance>: *L*
Undo/End/Pick Point/<Enter Left Distance>: *110*
End/Percent slope/<Slope Ratio (?:1) <2.0>>: *P*
Percent of grade slope: *2* This enters a slope of 2 in 100 for a distance of 110 feet to the left of the starting point.
Undo/End/Pick Point/<Enter Left Distance>: *30*
End/Percent slope/<Slope Ratio (?:1) <2.0>>: *4*
Undo/End/Pick Point/<Enter Left Distance>: *E* Entering E ends the command.

Pulldown Menu Location: Draw
Keyboard Command: PSR
Prerequisite: None
File Name: \lsp\slpline.lsp

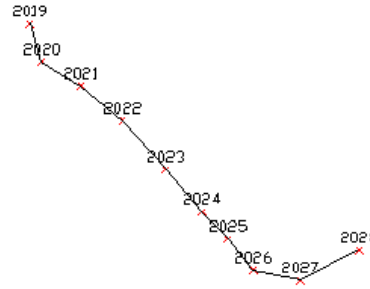
Polyline by Nearest Found

Function

This command draws a polyline by connecting points using a nearest found method. The points to connect can be specified either by entering point numbers or picking POINT entities on the screen. The nearest found method draws a polyline by starting at one of the points and then connecting to the closest of the remaining points. Then a remaining point that is closest to one of the polyline end points is added until all points are part of the polyline.

Prompts

Create 2D polyline at zero elevation or 3D polyline [<2d>/3d]? *press Enter*
Select point from screen or by point number (<Screen>/Number)? *press Enter*
Select points.
Select objects: *pick points*



Pulldown Menu Location: Draw
Keyboard Command: plnear
Prerequisite: None
File Names: \lsp\crdutil.arx

SmarTtrace

Function

SmartTrace is an enhanced sketch routine. AutoCAD's *Sketch* command is acceptable for some tracing, but if a large contour map is sketched, it creates a huge file that loads and regenerates slowly. The problem is that the sketch command creates points at user specified increments, this small increment may be appropriate for sharp corners, however, in relatively straight stretches this is very inefficient.

SmartTrace solves this problem. The routine works by reducing the number of vertices created on polyline tracing by using a deflection angle and minimum and maximum distance. In sharp turns, it will create points at the minimum distance specified, and in relatively straight stretches it creates points at the maximum distance specified. If the angle of the polyline turns more than the specified deflection angle, SmartTrace also creates a point.

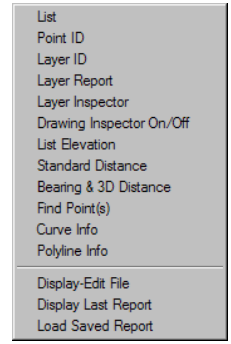
Prompts

Deflection Angle <4.0>: *press Enter* A range of 3 to 5 degrees is best.
Minimum Distance <5.0>: *press Enter* Usually 5% of map scale, or 1/20 inch.
Maximum Distance <50.0>: *press Enter* Usually 50% of map scale, or 1/2 inch.
Start point: *pick beginning point on polyline*
Begin Tracing ... Press Pick Button to End. Carefully move along polyline. *press the pick button to complete the polyline*

Pulldown Menu Location: Draw
Keyboard Command: TABLET3
Prerequisite: None
File Name: \lsp\tablet.lsp

Inquiry Menu

Shown here is the Carlson Inquiry menu. The top section contains detailed inquiry commands. The lower section of the menu includes report and file editing commands.



Point ID

Function

This command reports complete information pertaining to a Carlson point. Although similar in function to the AutoCAD *ID* command, this routine is much more detailed. With this command, you are given the point number, as well as the northing, easting and elevation coordinates. You also are given the point description, and you are shown the name and the location of the coordinate file for the point.

Prompts

Pick point or point number: *255*

```
 PointNo.  Northing(Y)  Easting(X) Elev(Z)   Description
255       4379.83      4265.48    19.01     GROUND/SHOT
N: 4379.83  E: 4265.48  Z: 19.01
PT#: 255  CRD File: c:\Carlson2007\data\mantopo.crd
```

Pulldown Menu Location: Inquiry
Keyboard Command: PT_ID
Prerequisite: None
File Name: \lsp\pt_id.lsp

Layer ID

Function

This command reports the layer name of the selected entity.

Prompts

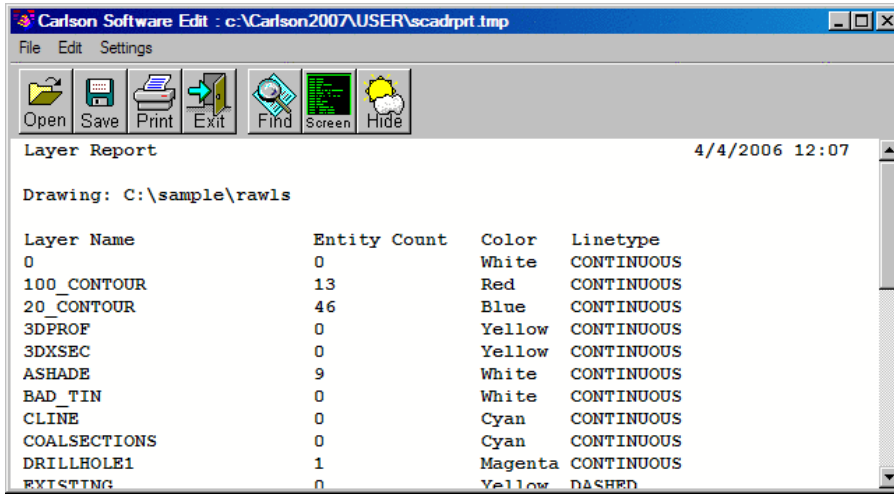
Pick entity to read layer: *pick an entity*
Layer: FINAL
Pick entity to read layer: *press Enter to end*

Pulldown Menu Location: Inquiry
Keyboard Command: layerid
Prerequisite: None
File Name: \lsp\surv1.lsp

Layer Report

Function

This command generates a report containing each layer name, the number of entities on each layer, the color and the linetype applied to each layer.

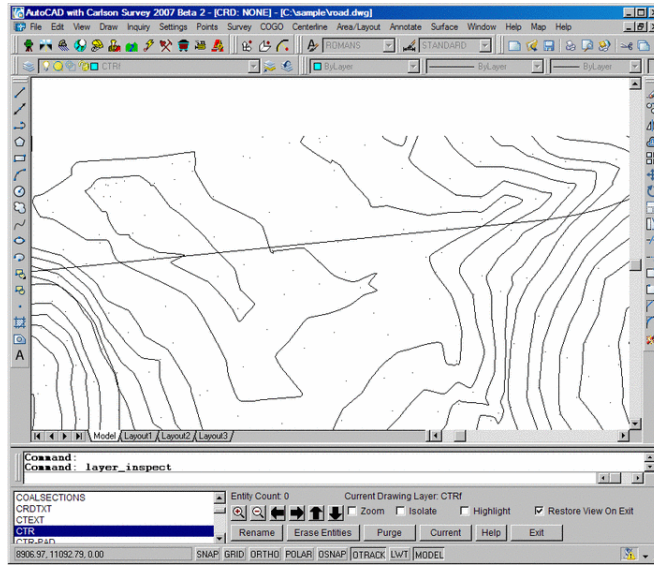

Carlson Software Edit : c:\Carlson2007\USER\scadrpt.tmp
File Edit Settings
Open Save Print Exit Find Screen Hide
Layer Report 4/4/2006 12:07
Drawing: C:\sample\rawls
Layer Name Entity Count Color Linetype
0 0 White CONTINUOUS
100_CONTOUR 13 Red CONTINUOUS
20_CONTOUR 46 Blue CONTINUOUS
3DPROF 0 Yellow CONTINUOUS
3DXSEC 0 Yellow CONTINUOUS
ASHADE 9 White CONTINUOUS
BAD_TIN 0 White CONTINUOUS
CLINE 0 Cyan CONTINUOUS
COALSECTIONS 0 Cyan CONTINUOUS
DRILLHOLE1 1 Magenta CONTINUOUS
EXISTING 0 Yellow DASHED

Pulldown Menu Location: Inquiry
Keyboard Command: reportlayer
Prerequisite: None
File Name: \lsp\surv1.lsp

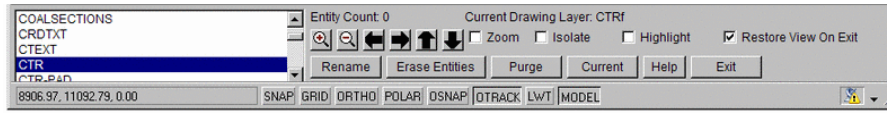
Layer Inspector

Function

This command is used to highlight, isolate and/or zoom to layers that are selected from a docked list. This command is ideal when you are working on a very dense and complex drawing, which has many layers. In some cases, there will be layers that you would want to erase. And another scenario might be that you'd like to highlight a layer that is hard to find and see.


AutoCAD with Carlson Survey 2007 Beta 2 - [CRD: NONE] - [C:\sample\road.dwg]
File Edit View Draw Inquiry Settings Points Survey COGO Centerline Area/Layout Annotate Surface Window Help Map Help
Model Layout1 Layout2 Layout3
Command:
Command: layer_inspect
COALSECTIONS
CRDTXT
CTEXT
CTR
Entity Count: 0
Current Drawing Layer: CTR
Zoom Isolate Highlight Restore View On Exit
Rename Erase Entities Purge Current Help Exit
8906.97, 11092.79, 0.00
SNAP GRID ORTHO POLAR OSNAP OTRACK LWT MODEL

At the bottom of this special interface screen is the control panel that is shown below. Note the selectable, scrolling layer list on the far-left side. Once a layer is selected,

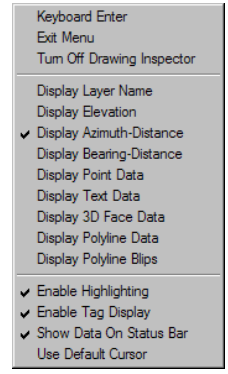


Pulldown Menu Location: Inquiry
Keyboard Command: layer_inspect
Prerequisite: None
File Name: \lsp\contour4.arx

Drawing Inspector

Function

This command reports object properties to you as you move the cursor over an entity. Once the *Drawing Inspector* is activated by running the *Drawing Inspector* command, you can display one of several properties of an object. The available properties are: Layer Name, Elevation, Azimuth-Distance, Bearing-Distance, Point Data, Text Data, 3D Face Data, Polyline Data and Polyline Blips. You can simply move the pointer over an entity and the selected property will be displayed either in a pop-up window next to the pointer and/or on the status bar, depending on the selected option. The options for this command are set in the menu that pops up by clicking the right mouse button.



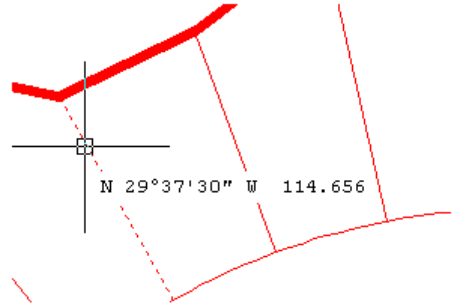
In the *Drawing Inspector* menu, you can choose one or more properties to display.

Display Layer Name: Allows you to display the layer name of the entity.
Display Elevation: Allows you to display the elevation of the entity.
Display Azimuth-Distance: Allows you to display the azimuth and distance of a line.
Display Bearing-Distance: Allows you to display the bearing and distance of a line.
Display Point Data: Allows you to display the coordinate data of point.
Display Text Data: Allows you to display the attributes of text.
Display 3D Face Data: Allows you to display the Z elevations at the face corners.
Display Polyline Data: Allows you to display the end point elevations, horizontal distance, slope distance and slope ratios.
Display Polyline Blips: Allows you to displays the blip locations.

In the *Drawing Inspector* menu, you can also choose how the property information is reported.

Enable Highlighting: Allows you to highlight the object that the *Drawing Inspector* is reporting.
Enable Tag Display: Enables you to view the information next to the cursor on the screen.
Show Data On Status Bar: Enables you to view the information on the status bar, in the lower corner of the screen.
Use Default Cursor: When enabled, only the AutoCAD cursor shows. When disabled, the mouse pointer is also shown.

Other commands can be run as usual while *Drawing Inspector* is active. Other ways to turn off the *Drawing Inspector* are to pick the *Drawing Inspector* command from the pulldown menu a second time, or use the keyboard command a second time.



Example of Drawing Inspector reporting Bearing-Distance using the Tag Display

Pulldown Menu Location: Inquiry
Keyboard Command: inspector
Prerequisite: None

File Name: \lsp\autotag.arx

Bearing & 3D Distance

Function

This command reports the slope distance, slope ratio, bearing, azimuth and vertical angle between two 3D points. Pick or enter the coordinates of two points or select a line or polyline segment to calculate between the segment endpoints.

Prompts

Specify bearing-distance from (Line/PLine/<Points>)? *press Enter*
Pick point or enter point number: *pick a point*
Pick second point or enter point number: *pick a point*
Horiz Dist: 233.4 Slope Dist: 233.4 Elev Diff: 0.0 Vert Ang: 0d0'0"
Slope: 0.0% 0.0:1 Bearing: S 71d15'37" W Azimuth: 198d44'23"

Pulldown Menu Location: Inquiry
Keyboard Command: 3DIST
Prerequisite: None
File Name: \lsp\3dist.lsp

Find Point

Function

This command can be used to find a point in the current CRD file with a certain point number or description. For example, if you entered RAD* the command would plot a preview arrow at all the points that have the letters RAD as part of the description. i.e. RADPT1, RADPT2, RADPT3, etc. This command is not case sensitive (test is considered the same as TEST). Matching points are highlighted on the graphics screen with the preview arrow and listed on the text screen.

Prompts

Find by point [N]umber or [D]escription <N>: *press Enter*
Point number or range of point numbers to find <1>: *8*10*
8 4856.75 4747.20 0.00
9 4909.25 4648.37 0.00

10 4223.30 4545.46 0.00 RADPT

If you respond with *D* for the first prompt the program prompts:
Conforms to AutoCAD's wild card matching.
Point Description(s) text to search for <>: *rad∗*
Searching file C:\Carlson/DATA/LOT.CRD for point descriptions matching RAD∗ ...
7 4817.02 4662.73 0.00 RADPT
10 4223.30 4545.46 0.00 RADPT
Point(s) found 2

Pulldown Menu Location: Inquiry
Keyboard Command: fpnt
Prerequisite: None
File Name: \lsp\fpoint.lsp

Curve Info

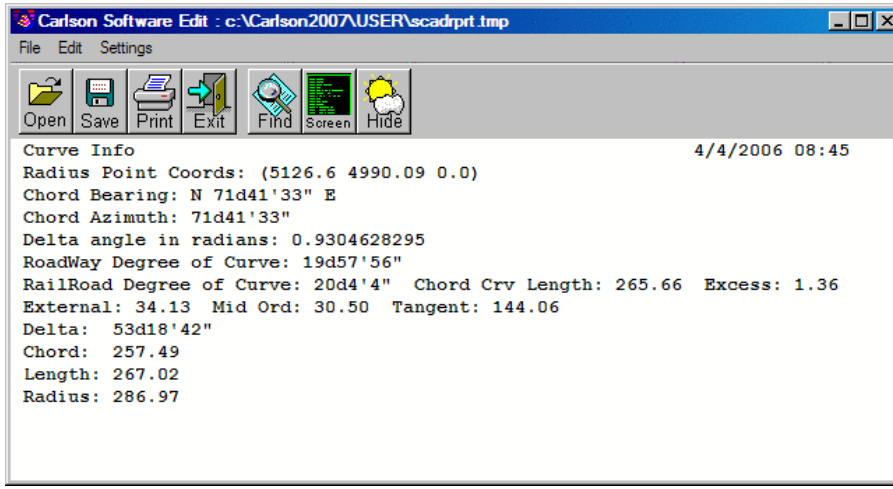
Function

This command displays information about a curve/arc. The curve can be defined by an arc entity or polyline arc segment or by selecting three points on the arc. The three points can be defined by point number or picked on the screen. The curve data is displayed in the text window with an option to be displayed in the Standard Report Viewer. Click Exit to return to the graphics window.

Prompts

Define arc by, Points/<select arc or polyline>: *select the arc entities*
Endpoint: (4923.81 5193.15 0.0)
Other Endpoint: (5168.27 5274.03 0.0)
Radius Point Coords: (5126.6 4990.09 0.0)
Chord Bearing: N 71d41'33" E
Chord Azimuth: 71d41'33"
Delta angle in radians: 0.9304628295
RoadWay Degree of Curve: 19d57'56"
RailRoad Degree of Curve: 20d4'4" Chord Crv Length: 265.66 Excess: 1.36
External: 34.13 Mid Ord: 30.50 Tangent: 144.06
Delta: 53d18'42"
Chord: 257.49
Length: 267.02

Radius: 286.97
Display curve data in report viewer [Yes/<No>]? *Y*


Carlson Software Edit : c:\Carlson2007\USER\scadrpt.tmp
File Edit Settings
Open Save Print Exit Find Screen Hide
Curve Info 4/4/2006 08:45
Radius Point Coords: (5126.6 4990.09 0.0)
Chord Bearing: N 71d41'33" E
Chord Azimuth: 71d41'33"
Delta angle in radians: 0.9304628295
RoadWay Degree of Curve: 19d57'56"
RailRoad Degree of Curve: 20d4'4" Chord Crv Length: 265.66 Excess: 1.36
External: 34.13 Mid Ord: 30.50 Tangent: 144.06
Delta: 53d18'42"
Chord: 257.49
Length: 267.02
Radius: 286.97

Pulldown Menu Location: Inquiry
Prerequisite: None
Keyboard Command: cinfo
File Name: \lsp\curvinfo.lsp

Polyline Info

Function

This command reports the length and elevation of the selected polyline or line.

Prompts

Pick Polyline or Line: *pick a polyline or line*
Polyline length: 7702.75 Slope distance: 7702.75 Avg elev: 1700.00 Avg slope: 0.00%

Pulldown Menu Location: Inquiry
Keyboard Command: polylen

Prerequisite: None
File Name: \lsp\polylen.lsp

Display-Edit File

Function

This command allows you to edit or review an ASCII/text file. Files are displayed in the *Standard Report Viewer* section of this manual.

Pulldown Menu Location: Inquiry
Keyboard Command: scedit
Prerequisite: A file to edit
File Names: \lsp\scedit.lsp, \lsp\scadutil.arx, \lsp\scedit.dcl

Display Last Report

Function

This brings up the last report generated by any Carlson command that uses the standard report viewer.

Pulldown Menu Location: Inquiry
Keyboard Command: report_up
Prerequisite: A previously viewed report
File Name: \lsp\quickkey.lsp

Load Saved Report

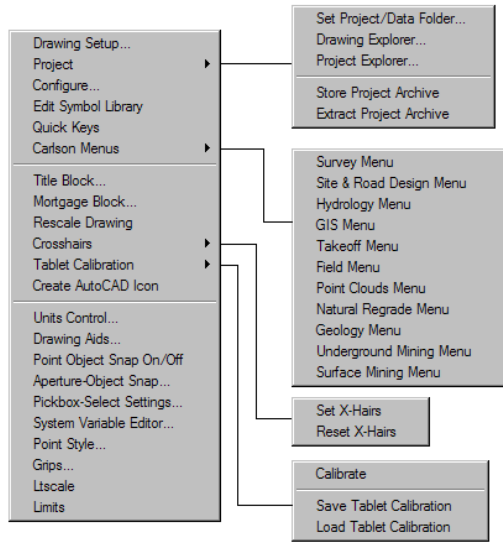
Function

This brings up the Report Formatter for the report data file saved previously by the Report Formatter.

Pulldown Menu Location: Inquiry
Keyboard Command: load_report
Prerequisite: A saved report
File Name: \lsp\scadutil.arx

Settings Menu

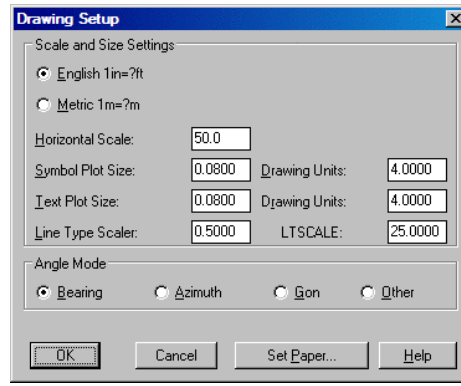
Shown here is the Carlson Settings menu. The top section contains the commands most important for setting up the drawing. You should run *Drawing Setup* prior to beginning your drawing. Additional setup and settings features are found in the middle section. The last section of the menu includes AutoCAD settings commands, including the *System Variable Editor*.



Drawing Setup

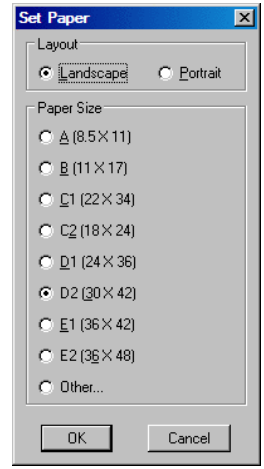
Function

This command allows you to specify drawing parameters, including the plotting scale, size of symbols, label annotation size, and the angle mode.



- Specify **English 1in=?ft** or **Metric 1m=?m** as the unit mode to use. This affects the prompting and reports. When you are working on a drawing in English units, one unit equals one foot. In metric, one unit equals one meter.
- Specify the **Horizontal Scale** of the drawing. For example, if the horizontal scale is set to 50, then 1" = 50' is your drawing scale.
- The **Symbol Plot Size** value is a scaler that represents the size on the plot. The Drawing Units are determined by multiplying the scaler by the horizontal scale. In English mode the scaler represents the plotted size in inches. In Metric mode, this value is the plotted size in centimeters. The **Drawing Units** field shows the result of the Symbol Plot Size value (the scaler) multiplied by the horizontal scale.
- The **Text Plot Size** value is a scaler that represents the size on the plot. The Drawing Units are determined by multiplying the scaler by the horizontal scale. In English mode the scaler represents the plotted size in inches. In Metric mode, this value is the plotted size in centimeters. The Text Plot Size is not entered in Drawing Units. The **Drawing Units** field shows the result of the Text Plot Size value (the scaler) multiplied by the horizontal scale.
- The **Line Type Scaler** option sets the linetype scale by multiplying this scaler by the horizontal scale.
- **Angle Mode-Bearing** sets reporting to bearing mode for any of the inquiry commands. (Modifies the settings in the AutoCAD *UNITS* command.)
- **Angle Mode-Azimuth** sets reporting to north based azimuth mode for any of the inquiry commands. (Modifies the settings in the AutoCAD *UNITS* command.)
- **Angle Mode-Gon** sets reporting to gon mode for any of the inquiry commands. (Modifies the settings in the AutoCAD *UNITS* command.)
- **Angle Mode-Other** lets the user determine angle mode by using the AutoCAD *UNITS* command.

- The **Set Paper** button allows you to draw a rectangle on the screen that represents the edge of your paper. After you have set the horizontal scale, press the Set Paper button and the Set Paper dialog appears.



  - The **Layout** option lets you specify landscape or portrait paper orientation. Landscape layout is where the width of the page is greater than the height of the page. Portrait layout is the opposite.
  - The **Paper Size** option allows you to specify the paper size. The numbers in parenthesis represent drawing units and will be multiplied by the horizontal scale to determine the rectangle to be drawn. If you select the Other option, you will be prompted on the command line for the horizontal and vertical sizes of the paper.

Prompts (for Set Paper)

Pick or Type lower left corner point for border <(5000.00 5000.00 0.0)>: *pick a point*
Erase existing Set Paper boundary [<Yes>/No]? *Y* This prompt only appears if there is an existing paper boundary in this drawing.
Set Limits [Yes/<No>]? *Y* If you answer Yes to Set Limits, drawing limits are enabled, and AutoCAD restricts the coordinates you can enter to within the paper boundary. Drawing limits also determines the area of the drawing that can display grid dots, and the minimum area displayed by the Zoom All command on the View menu. To turn drawing limits off, type in LIMITS on the command line and set to Off.

Drawing Setup also sets the AutoCAD dimension scale (DIMSCALE) and linetype scale (LTSCALE) to the Horizontal Scale.

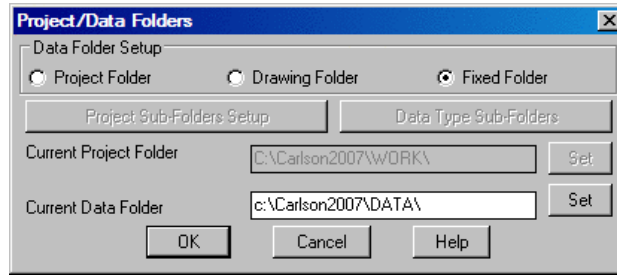
Pulldown Menu Location: Settings
Keyboard Command: setup
Prerequisite: None
File Names: \lsp\survset.lsp, \lsp\scadenvr.dcl

Set Project/Data Folders

Function

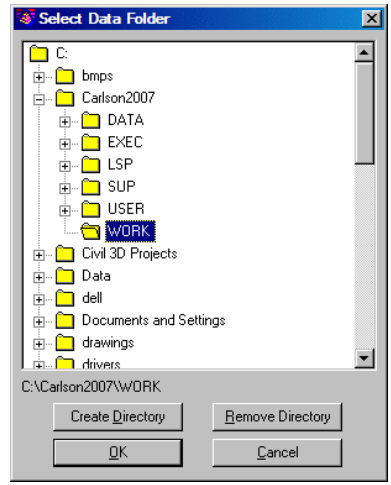
This command sets the data directory to use as the default directory for creating Carlson data files such as coordinate (.CRD) and profile (.PRO) files. The routine shows the tree structure of existing directories available on your computer. The first dialog provides you with a choice of three for the Data Folder Setup. The three options are Project Folder, Drawing Folder or Fixed Folder.

To create a new data directory, for example, note the Current Data Folder option at the bottom of the dialog, and see the Set button to the right. Click Set. A new dialog appears that will allow you to select the data folder of your choice. You can also create a new one. After you have made your choice, click OK. If you choose Then the program will prompt you for the new directory name. The Remove Directory button allows you to delete directories that have no files inside.



A new dialog appears that will allow you to select the data folder of your choice. You can also create a new one. After you have made your choice, click OK. If you choose Create Directory,

the program will prompt you for the new directory name. The Remove Directory button allows you to delete directories that have no files inside.



Pulldown Menu Location: Settings > Project
Keyboard Command: settmpdir
Prerequisite: None

Drawing Explorer

Function

The Drawing Explorer command presents a list of all Carlson data files that are made in association with a drawing. The knowledge of these files is contained in the .INI file that shares the drawing name (e.g. Estates.dwg, Estates.ini). If a drawing was not made in Carlson or does not have a companion .INI file, then Drawing Explorer will display "No Files". In *Configure* > General Settings, if Save Drawing INI Files is clicked off, then Drawing Explorer will again display "No Files". Drawing Explorer will also not show any data files where the drawing name starts with the seven letters "Drawing". Using any other file name, once data files are created such as a coordinate (.CRD) file, then Drawing Explorer will track these files in the order that they are created. Drawing Explorer helps manage drawing-related data.

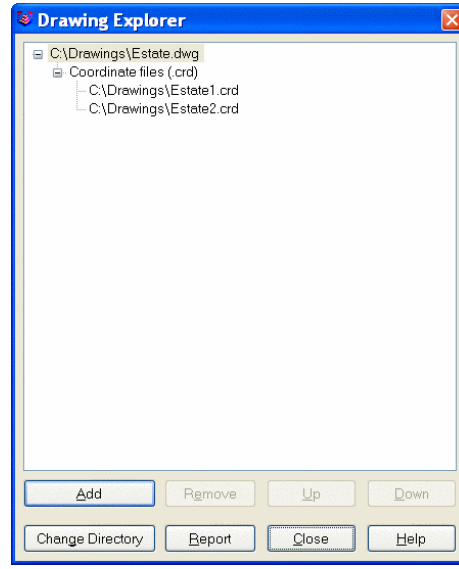
Example 1

If we are working in a drawing called Estates.dwg and create a coordinate file Estates.crd, then later create a second coordinate file called Estates-GPS.crd, Drawing Explorer would display the following:

The coordinate file created or modified last appears at the top of the list. All data files are displayed in the order of most recent to oldest. If the Estates.crd file is set as current by the command *Set Coordinate File*, then added to or revised, Estates.crd will move to the top of the list. Thus old, relatively unused files will gravitate to the bottom of the list.

Files are displayed by category. So far, we have only the Coordinate Files category. There are also Raw Field Note files (.RW5), profiles (.PRO), section files (.SCT) - in fact dozens of file type categories that will display once these files are actually created.

If a data file is selected and highlighted, the Up and Down keys will become enabled, and the user can move files up to the top of the list or otherwise alter their position. The position of files affects only the reporting of the files using the Report option in the lower left of the dialog. When highlighted, a file can be removed from the list (but it won't be deleted from the hard drive!). The Add option will add other older or non-referenced data files to the list of files associated with the drawing.



Example 2

As we do more work in the file Estates.dwg, data files will begin to proliferate and will appear in Drawing Explorer. Shown below is a more comprehensive list of files, with occasional examples of multiple files within the same category. Categories themselves float to the top of the list if any of their data files have been used more recently than data files in other categories.

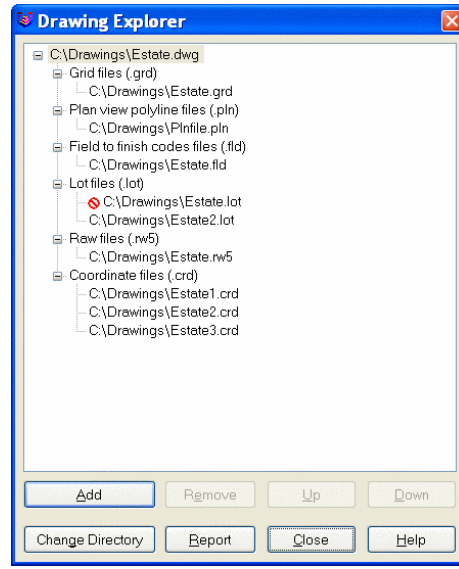
Note that there is even a Miscellaneous Files category, that includes ASCII point files created by the command Export Text/ASCII File.

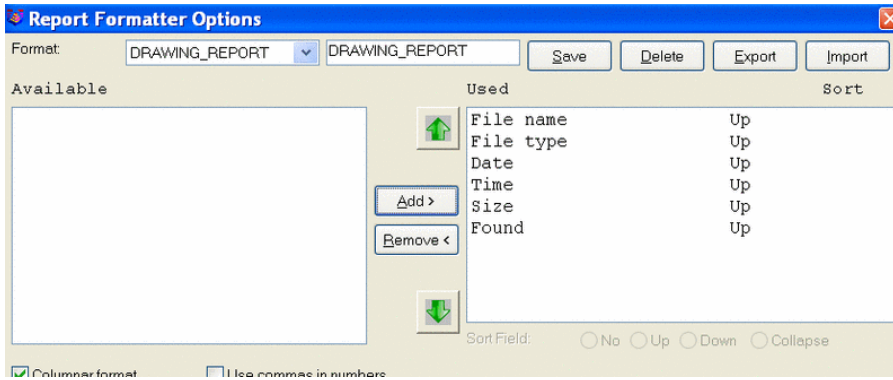
When many data files are involved, the Report option becomes very useful. Here you can use the Report Formatter to display, in any order, the File Name, File Type, Date last modified, Time last modified, Size in bytes, and whether it is Found (e.g. exists) in the specified directory. For example, if a file was created in a certain directory but moved using Windows Explorer to another directory without being further altered in Carlson, it would show up here as not found. ("No" would appear in the Found column).

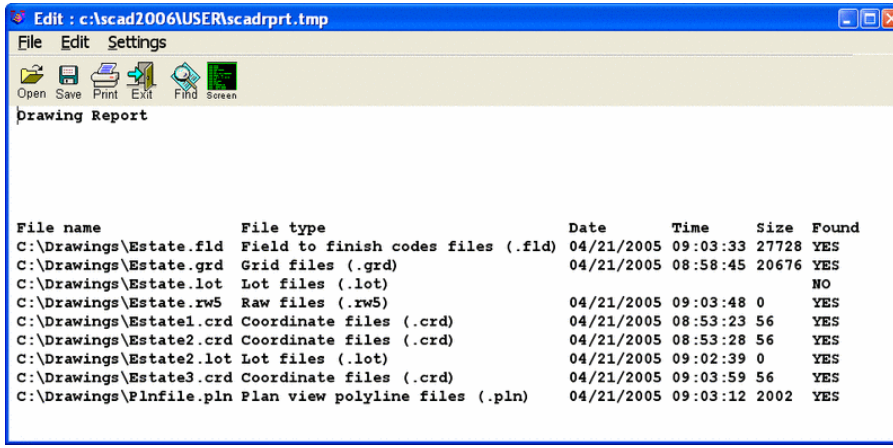
Shown here is a summary of our data files by size, with reporting of the found status. In this case, the Estates.Lot file has been moved or deleted.

The Report Formatter can be used to move to the right side all items that are desired for reporting, with the up-down options used to set the report order (e.g. File type first, File name second, etc.). Click the Display button (not shown above) that appears at the bottom of the Report Formatting Options dialog, to obtain the report shown here.

A deleted or missing file such as Estates.Lot will appear in Drawing Explorer with a special red [no entry] symbol as shown here.






Edit : c:\scad2006\USER\scadrprt.tmp
File Edit Settings
Open Save Print Exit Find Screen
Drawing Report
File name File type Date Time Size Found
C:\Drawings\Estate.fld Field to finish codes files (.fld) 04/21/2005 09:03:33 27728 YES
C:\Drawings\Estate.grd Grid files (.grd) 04/21/2005 08:58:45 20676 YES
C:\Drawings\Estate.lot Lot files (.lot) NO
C:\Drawings\Estate.rw5 Raw files (.rw5) 04/21/2005 09:03:48 0 YES
C:\Drawings\Estate1.crd Coordinate files (.crd) 04/21/2005 08:53:23 56 YES
C:\Drawings\Estate2.crd Coordinate files (.crd) 04/21/2005 08:53:28 56 YES
C:\Drawings\Estate2.lot Lot files (.lot) 04/21/2005 09:02:39 0 YES
C:\Drawings\Estate3.crd Coordinate files (.crd) 04/21/2005 09:03:59 56 YES
C:\Drawings\Plnfile.pln Plan view polyline files (.pln) 04/21/2005 09:03:12 2002 YES

Pulldown Menu Location: Settings > Project
Keyboard Command: dwgxplore
Prerequisite: None
File Name: \lsp\gisutil.arx

Project Explorer

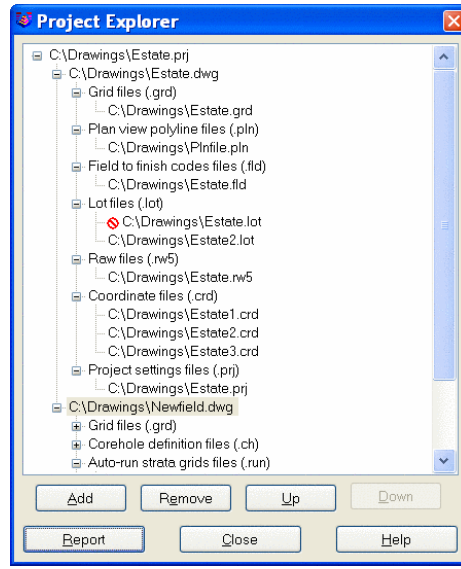
Function

This tool is used for management of a complete project. A project can contain numerous drawings, and each drawing within that project can contain numerous related files.

Think of the *Project Explorer* as the trunk of the hierarchical tree structure that develops into a project. While within each drawing, Carlson keeps track of the files that you create (such as grids and coordinates). These are related to the drawing and you can use *Drawing Explorer* to manage them. When management reaches the top level, the *Project Explorer* is used to tie these together.

Prompts

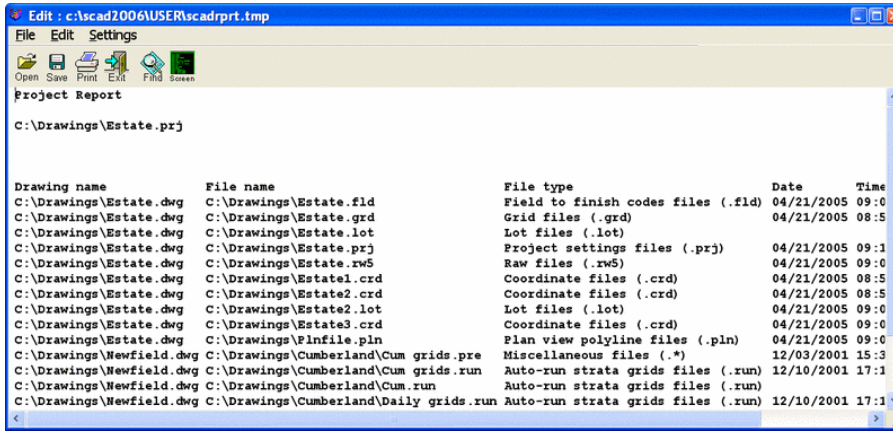
When you initiate the *Project Explorer*, you will be prompted to select an existing or create a new Project File. Project files end in the PRJ extension. Once a project file is open, the following dialog will appear.



Add: When you choose the Add button, you are prompted to select a drawing file to add to the project. The selected drawing file is added to the project tree along with any files related to the drawing.
Remove: When any branch of the tree structure (except the top root) is selected, it is removed. Keep in mind that removing any node of a tree structure removes all nodes under it.
Up/Down: When you select a branch of the tree structure that can be moved, the Up and Down buttons become available. This allows you to rearrange the items vertically.
Report: This option displays the Report Formatting Options for formatting the report of the Drawing Explorer (see Drawing Explorer).
When you choose the **Add** button you will be presented with a dialog to select a drawing to add to the project. Once a drawing is selected, it will be added to the project tree along with any files

related to the drawing.

The Report Formatter can be used to move to the right side all items that are desired for reporting, with the up-down options used to set the report order (e.g. File type first, File name second, etc.). Click the Display button that appears at the bottom of the Report Formatting Options dialog, to obtain the report shown here.

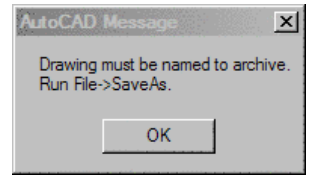

Edit : c:\scad2006\USER\scadrprt.tmp
File Edit Settings
Open Save Print Exit Find Screen
Project Report
C:\Drawings\Estate.prj
Drawing name File name File type Date Time
C:\Drawings\Estate.dwg C:\Drawings\Estate.fld Field to finish codes files (.fld) 04/21/2005 09:0
C:\Drawings\Estate.dwg C:\Drawings\Estate.grd Grid files (.grd) 04/21/2005 08:5
C:\Drawings\Estate.dwg C:\Drawings\Estate.lot Lot files (.lot)
C:\Drawings\Estate.dwg C:\Drawings\Estate.prj Project settings files (.prj) 04/21/2005 09:1
C:\Drawings\Estate.dwg C:\Drawings\Estate.rw5 Raw files (.rw5) 04/21/2005 09:0
C:\Drawings\Estate.dwg C:\Drawings\Estate1.crd Coordinate files (.crd) 04/21/2005 08:5
C:\Drawings\Estate.dwg C:\Drawings\Estate2.crd Coordinate files (.crd) 04/21/2005 08:5
C:\Drawings\Estate.dwg C:\Drawings\Estate2.lot Lot files (.lot) 04/21/2005 09:0
C:\Drawings\Estate.dwg C:\Drawings\Estate3.crd Coordinate files (.crd) 04/21/2005 09:0
C:\Drawings\Estate.dwg C:\Drawings\Plnfile.pln Plan view polyline files (.pln) 04/21/2005 09:0
C:\Drawings\Newfield.dwg C:\Drawings\Cumberland\Cum grids.pre Miscellaneous files (.*) 12/03/2001 15:3
C:\Drawings\Newfield.dwg C:\Drawings\Cumberland\Cum grids.run Auto-run strata grids files (.run) 12/10/2001 17:1
C:\Drawings\Newfield.dwg C:\Drawings\Cumberland\Cum.run Auto-run strata grids files (.run)
C:\Drawings\Newfield.dwg C:\Drawings\Cumberland\Daily grids.run Auto-run strata grids files (.run) 12/10/2001 17:1

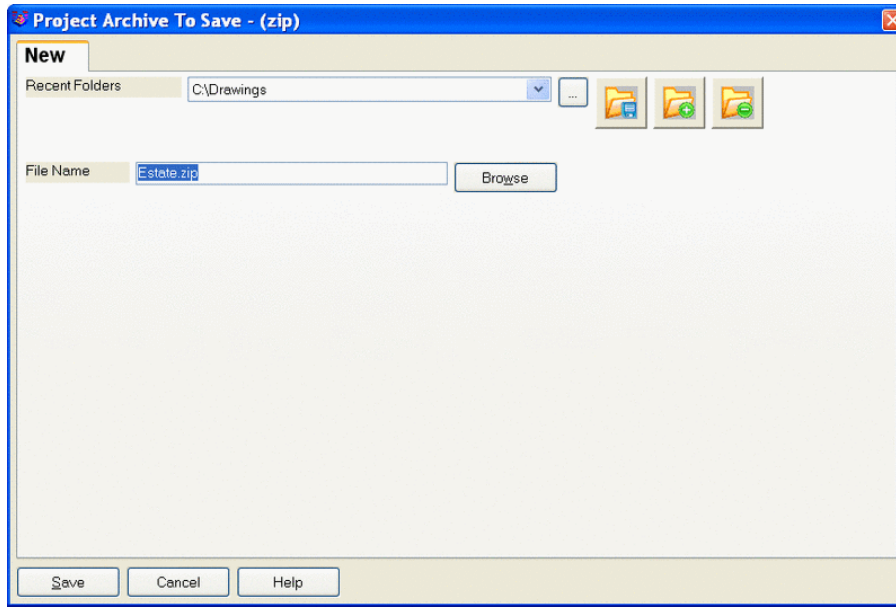
Pulldown Menu Location: Settings > Project
Keyboard Command: prjxplore
Prerequisite: None
File Name: \lsp\gisutil.arx

Store Project Archive

Function

This command will zip and archive an entire project. The archive contains the drawing file (.dwg) and all the associated data file such as the surfaces. The data files associated with the current project can be reviewed with the Drawing Explorer command. The format of the archive file is a standard .zip file which can be used by WinZip. This file can be sent to someone who can unzip it and use all the same files. If the drawing hasn't been saved recently, the following window appears first.





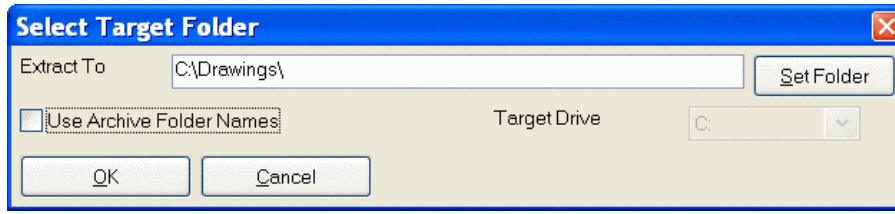
Pulldown Menu Location: Settings > Project
Keyboard Command: zip_project
Prerequisite: A project file
File Name: \lsp\contour4.arx

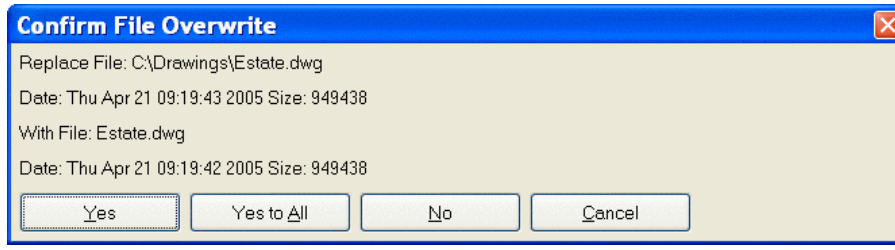
Extract Project Archive

Function

This command will unzip an archive file that has been previously created with the command Store Project Archive. It prompts for the directory to unzip to. If any of the files already exist in

the folder it is extracting to, there is a window prompting to overwrite the files.



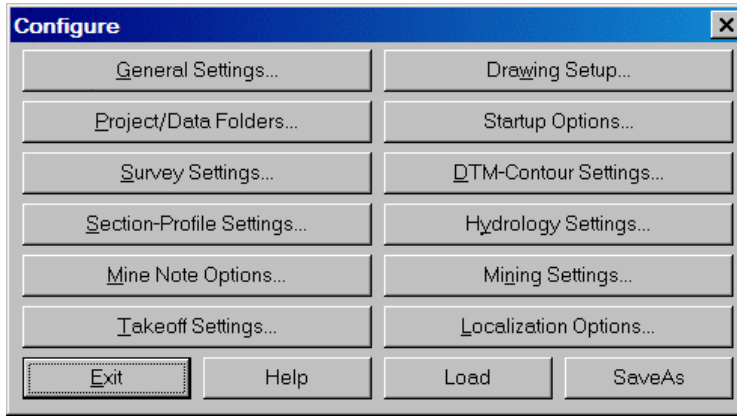


Pulldown Menu Location: Settings > Project
Keyboard Command: unzip_project
Prerequisite: A project file that has been zipped (ZIP)

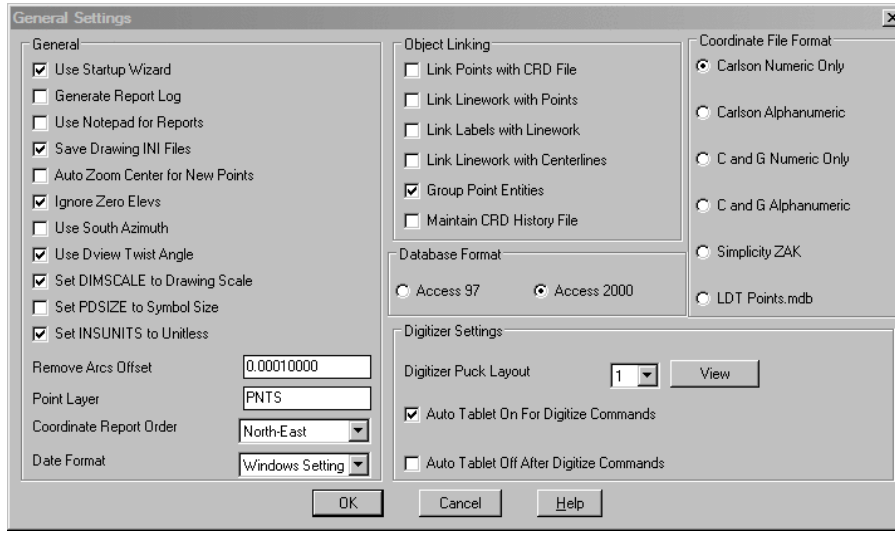
Configure

Function

This command allows you to set up the default settings that are used each time you start a new drawing, or load an existing drawing. These settings are stored in files called Carlson.INI, COGO.INI, SCTPRO.INI, DTM.INI, HYDRO.INI, and MINE.INI in the Carlson USER directory. *Configure* will restore the current drawing settings to these default settings. These global settings can be saved and loaded on a new computer, or for a new installation of Carlson.



The settings for the modules apply to the commands within those modules. Refer to the associated manual chapters for additional descriptions of these settings. Under General Settings there are options that apply to all modules. Many of these options are only accessed in *Configure,* and will be described here.



Use Startup Wizard: The *Use Startup Wizard* controls whether this wizard appears when creating a new drawing.

Generate Report Log: When the Generate Report Log option is on, output from several commands will be accumulated in a report buffer. Commands that output to the report log include Inverse, Traverse, Curve Info, etc. Also any report that is displayed in the standard report viewer is also added to the report log. While activated, the report log resides in the lower left corner of the desktop as a minimized title bar that shows how many lines are in the report buffer. To view the report log, pick on the maximize icon on this title bar. You can also view the report log by running the Display Report Log function in the Misc menu. The report log can be edited, saved to a file or printed. To quickly turn the report log on and off, you can type REPORT at the command prompt. This function toggles the report log on/off.

Use Notepad for Reports: When Use Notepad for Reports is turned on, whenever a report is generated, it will appear in a Windows Notepad instead of the Carlson Report Viewer.

Save Drawing INI Files: Save Drawing INI Files will create an .INI with the same name as the .dwg file to store the project data files for the drawing.

Auto Zoom Center for New Points: This option zooms the display to center the new, located point. If it is off, the screen does not center the new point.

Ignore Zero Elevs: This option will ignore any entities with a zero elevation. It is used for many commands, such as Triangulate and Contour or Make Grid File.

Use South Azimuth: Turning on this option will use a South Azimuth instead of a North Azimuth, which is the default.

Use Dview Twist Angle: This will use the screen Twist Angle defined with the AutoCAD command DVIEW. This is similar to Twist Screen.

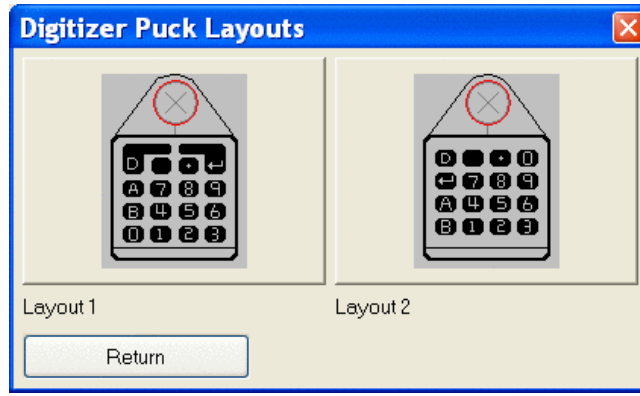
Set Dimscale to Drawing Scale: This will set the dimension scale to match the drawing scale. By default, it is set to 40.0.

Set PDSIZE to Symbol Size: This will set the PDSIZE scale to match the symbol size defined in Drawing Setup. By default, it is set to 4.0.

Point Layer: This is the default layer to draw any new points.

Date Format: You can control the display of dates in Carlson reports with this dropdown menu. The default is 'Windows Setting' which allows you to control it with Windows Control Panel. Several other common formats are available.

Digitizer Puck Layout & View: There are two main formats for the digiter puck. They are numbered 1 and 2. Selecting the View button brings up the window showing the two formats.



Auto Tablet On for Digitize Commands: This option will activate the auto tablet when using the digitize commands.

Put Data Files in DWG Directory: The Put Data Files in DWG Directory will set the Data Path to the directory of the drawing. The Data Path is the default directory for Carlson data files such as the coordinate (.CRD) files, profile (.PRO) files, etc.

MS Excel Path: This sets the path to the Excel.exe file for launching Excel from the Report Formatter. Many different reports can be exported directly into Excel.

Coordinate Report Order: You can choose the traditional north-east format, or reverse these in reports with east-north.

Object Linking: The Object Linking section contains options for creating reactors to the drawing entities. The Link Points with CRD File option will attach a reactor to the Carlson point entities so that any change to the entities such as MOVE or ROTATE will update the coordinates in the CRD file. The Link Linework with Points option will attach reactors to line and polyline entities that are drawn by point number so that moving the points will automatically move the linework. The Link Labels with Linework applies to bearing/distance annotation. This link with update the annotation when the linework is modified. The Group Point Entities option joins the three entities of a Carlson point (attribute block, symbol, node). For each point, selecting any one of these entities selects all three entities for the point. See the Points Menu Commands and Dynamic Annotation sections of the manual for more information about linking.

Database Format: The Database Format chooses between Microsoft® Access 97 or 2000 (and higher) format. This database format applies to creating new database (.MDB) files in the GIS module, the drillhole database and the Export to Microsoft® Access option in the Report Formatter.

CRD File Pt# Format: Carlson can run live on any of these coordinate file formats. The CRD

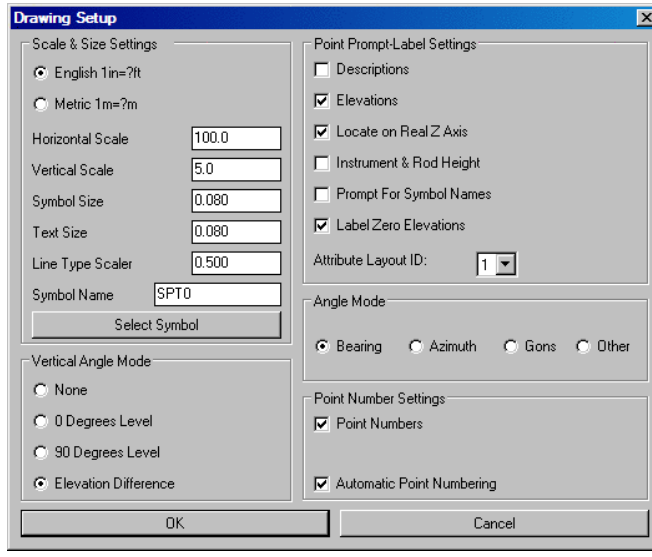
File Pt# Format option sets point number format for coordinate files as one of the following. Here are the options:

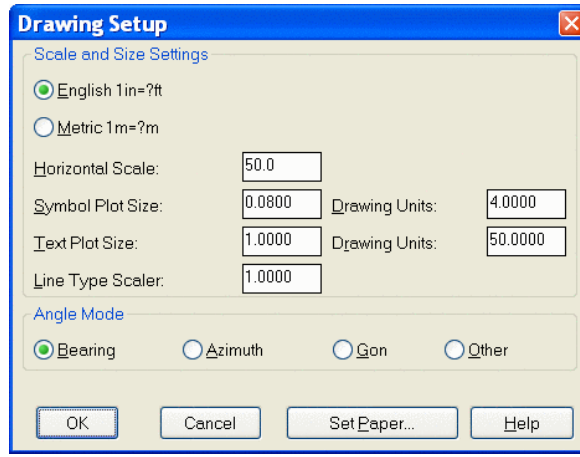
- **Carlson Numeric:** This is the default format upon installation. Point numbers cannot contain letters and must be in the range from 1 to 32767.
- **Carlson Alphanumeric:** This native Carlson format allows letters in the point numbers, and the point name can be up to 10 characters. Any combination of letters and numbers is acceptable.
- **C&G Numeric:** This format of the C&G division supports up to 5 digits, with a 65000 point limit.
- **C&G Alphanumeric:** This format of the C&G division supports up to 10 characters, with no limit to the number of points.
- **Simplicity ZAK:** This is the Simplicity Systems coordinate file format.

- **LDT Points.mdb:** This is a Microsoft Access database used by Autodesk Land Desktop. The file is typically named "points.mdb" and is found in a projects \COGO directory. The number limitation is established by the database structure, but is frequently numeric and allows unlimited point numbers.

Drawing Setup:

The settings under *Drawing Setup* are very similar to the AutoCAD Drawing Setup, which is also shown below for comparison. There are a few additions, such as Vertical Scale, Point Prompt-Label Settings, Point Number Settings and Vertical Angle Mode.

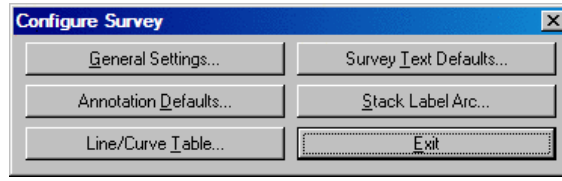


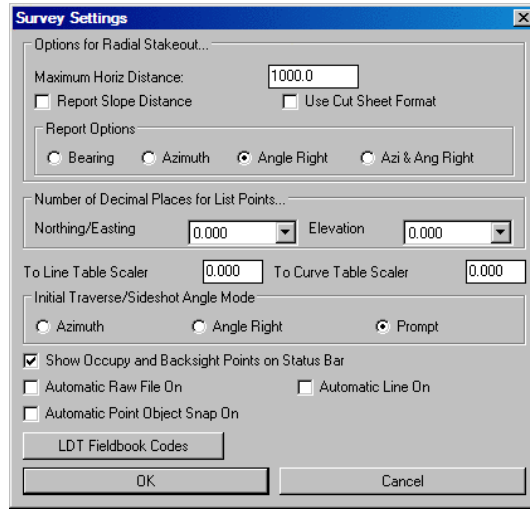


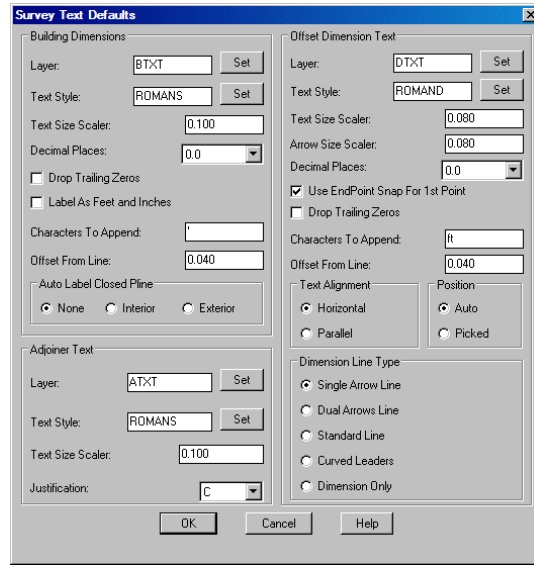
There is also the ability to maintain two different sets of defaults (English and Metric). The user can maintain a comfortable set of settings for either unit system, especially if they constantly switch back and forth. Also added was support for meters/metres, tons/tonnes and various date representation. This dialog is accessed from the *Configure* menu choice, using the Localization Settings button.

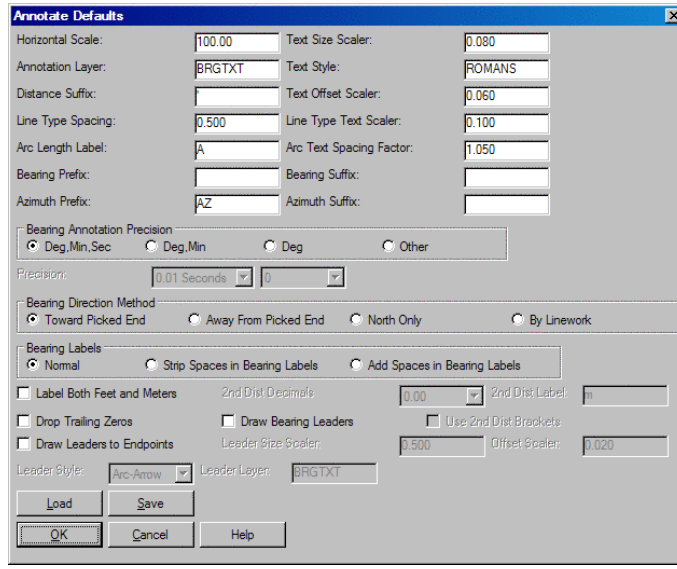
Survey Settings:

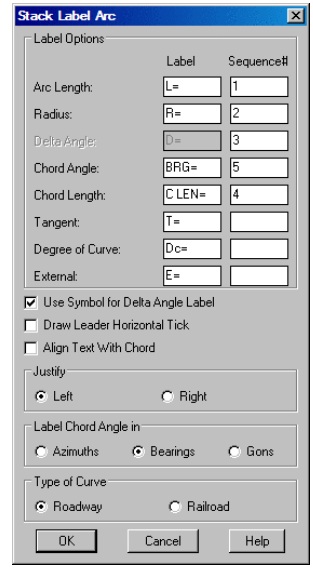
There are five different areas for default Survey Settings. These all appear elsewhere in Survey, but if you set them there, they will just apply for that drawing. If you make changes here, it will apply to the current and/or future drawings. Since each is defined elsewhere in the Survey chapter, each is not detailed here, just the dialog for viewing.

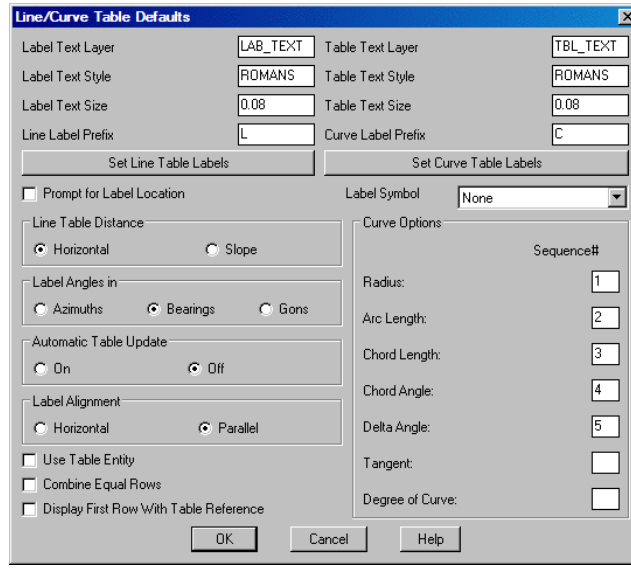



Survey Settings
Options for Radial Stakeout...
Maximum Horiz Distance:
1000.0
Report Slope Distance
Use Cut Sheet Format
Report Options
Bearing
Azimuth
Angle Right
Azi & Ang Right
Number of Decimal Places for List Points...
Northing/Easting
0.000
Elevation
0.000
To Line Table Scaler
0.000
To Curve Table Scaler
0.000
Initial Traverse/Sideshot Angle Mode
Azimuth
Angle Right
Prompt
Show Occupy and Backsight Points on Status Bar
Automatic Raw File On
Automatic Line On
Automatic Point Object Snap On
LDT Fieldbook Codes
OK
Cancel

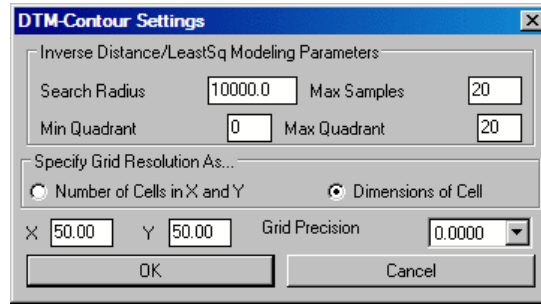

Survey Text Defaults
Building Dimensions
Layer:
BTXT
Set
Text Style:
ROMANS
Set
Text Size Scaler:
0.100
Decimal Places:
0.0
Drop Trailing Zeros
Label As Feet and Inches
Characters To Append:
'
Offset From Line:
0.040
Auto Label Closed Pline
None
Interior
Exterior
Adjoiner Text
Layer:
ATXT
Set
Text Style:
ROMANS
Set
Text Size Scaler:
0.100
Justification:
C
Offset Dimension Text
Layer:
DTXT
Set
Text Style:
ROMAND
Set
Text Size Scaler:
0.080
Arrow Size Scaler:
0.080
Decimal Places:
0.0
Use EndPoint Snap For 1st Point
Drop Trailing Zeros
Characters To Append:
ft
Offset From Line:
0.040
Text Alignment
Horizontal
Parallel
Position
Auto
Picked
Dimension Line Type
Single Arrow Line
Dual Arrows Line
Standard Line
Curved Leaders
Dimension Only
OK
Cancel
Help


Annotate Defaults
Horizontal Scale:
100.00
Text Size Scaler:
0.080
Annotation Layer:
BRGTXT
Text Style:
ROMANS
Distance Suffix:
Text Offset Scaler:
0.060
Line Type Spacing:
0.500
Line Type Text Scaler:
0.100
Arc Length Label:
A
Arc Text Spacing Factor:
1.050
Bearing Prefix:
Bearing Suffix:
Azimuth Prefix:
AZ
Azimuth Suffix:
Bearing Annotation Precision
Deg,Min,Sec
Deg,Min
Deg
Other
Precision:
0.01 Seconds
0
Bearing Direction Method
Toward Picked End
Away From Picked End
North Only
By Linework
Bearing Labels
Normal
Strip Spaces in Bearing Labels
Add Spaces in Bearing Labels
Label Both Feet and Meters
2nd Dist Decimals:
0.00
2nd Dist Label:
m
Drop Trailing Zeros
Draw Bearing Leaders
Use 2nd Dist Brackets
Draw Leaders to Endpoints
Leader Size Scaler:
0.500
Offset Scaler:
0.020
Leader Style:
Arc-Arrow
Leader Layer:
BRGTXT
Load
Save
OK
Cancel
Help


Stack Label Arc
Label Options
Label
Sequence#
Arc Length:
L=
1
Radius:
R=
2
Delta Angle:
D=
3
Chord Angle:
BRG=
5
Chord Length:
C LEN=
4
Tangent:
T=
Degree of Curve:
Dc=
External:
E=
Use Symbol for Delta Angle Label
Draw Leader Horizontal Tick
Align Text With Chord
Justify
Left
Right
Label Chord Angle in
Azimuths
Bearings
Gons
Type of Curve
Roadway
Railroad
OK
Cancel
Help



DTM-Contour Settings:



Most of the DTM-Contour commands will remember the settings and parameters used from drawing to drawing. There are some in this screen that will be used for griding and modeling.

Inverse Distance/LeastSquares Modeling Parameters: The modeling methods of Inverse Distance and Least Squares are similar ways to create a grid from datapoints or drillholes. It is not recommended to use these methods for griding contour or breaklines. Triangulation is better for

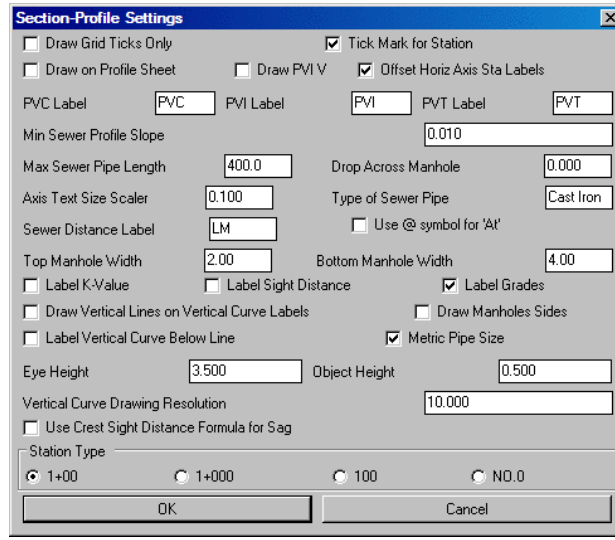
that. These methods need a search radius defined. Anything past this distance from one data point to the next will be ignored for influence. The Max Samples are the number of data points that will be used to influence each data point. The area is broken into 4 quadrants. The Min and Max Quadrant are the numbers of data points that will be used in each quadrant.

Specify Grid Resolution As: There are two ways to create a grid file. Once the boundary has been selected, the cells need to be determined. Number of Cells in X and Y will divide the boundary up into the specified number of cells. These will then be odd shaped rectangles, with the size calculated by the boundary dimensions and the number of cells. The Dimensions of Cells is the more commonly used method. This will allow for a set cell size for the X and Y directions. Most of the time the grid cells should be square, where you set the size.

Grid Precision: This is the number of decimals that are stored in the grid file.

Section-Profile Settings:

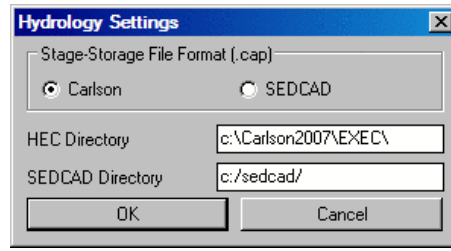
This configuration box is used mainly for text and drafting settings. Items such as text size scalers and station types are set here and will apply to the current and/or future drawings. These are very self explanatory and are up to the user to set if something other than the defaults is desired.



Hydrology Settings:

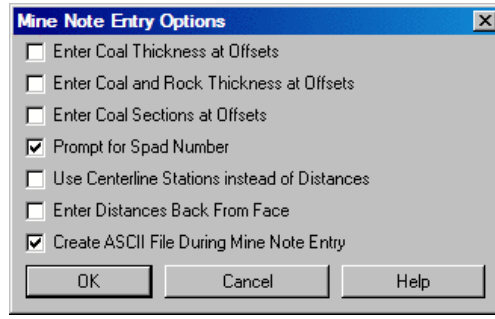
This section contains only three configuration settings. The first is the format of the stage-storage

capacity file. The second is the location of the HEC program files. The third is the SEDCAD directory location, if it is installed on the computer.



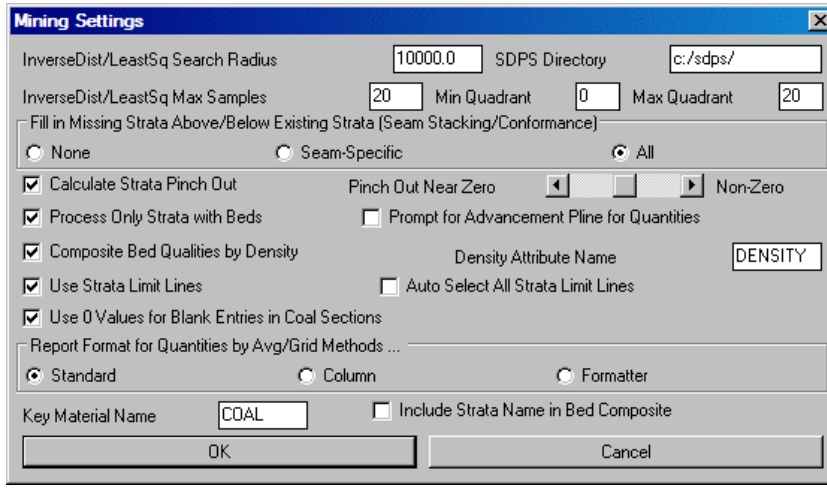
Mine Note Options:

These options are settings for prompting when entering the mine notes. They are simply turned on or off for customized mine note entry.


Mine Note Entry Options
Enter Coal Thickness at Offsets
Enter Coal and Rock Thickness at Offsets
Enter Coal Sections at Offsets
Prompt for Spad Number
Use Centerline Stations instead of Distances
Enter Distances Back From Face
Create ASCII File During Mine Note Entry
OK
Cancel
Help

Mine Settings:

This is the configuration screen for default settings used with the Mining Modules. Each item is detailed below.



Inverse Distance/Least Squares Search Radius, Samples and Quadrants: The modeling methods of Inverse Distance and Least Squares are similar ways to create a grid from datapoints or drillholes in that they use the same settings. It is not recommended to use these methods for griding contour or breaklines. Triangulation is better for that. These methods need a search radius defined. Anything past this distance from one data point to the next will be ignored for influence. The Max Samples are the number of data points that will be used to influence each data point. The area is broken into 4 quadrants. The Min and Max Quadrant are the numbers of data points that will be used in each quadrant.

SDPS Directory: This is the directory that the SDPS program (Subsidence Deformation Prediction System) is installed in, if it is on the computer.

Fill in Missing Strata Above/Below Existing Strata (Seam Stacking/Conformance): This important setting is used for griding and modeling from drillholes. It does two things. The first item it controls is to fill in missing strata. For example, if a drillhole does not go deep enough to penetrate a deep seam, or a drillhole is drilled down in a valley or low spot, it will either fill in (carry the seam through the hole) or pinch it out at the hole. None will not fill it in, meaning it will pinch the seam out at the shallow or partial hole. All will not pinch the seams out at the shallow or partial hole. Seam-Specific will use the Define Strata settings where the marker and target beds are defined there. The second modeling concept this controls is conformance. In these same partial holes where certain seams are not encountered, when it fills them in, it controls how it behaves. None will let each seam do want they want, independent of any other seam. All has all the seams looking at each other and they all conform to each other. Seam-Specific will use the Define Strata settings where the marker and target beds are defined there. The marker bed is

the "main" seam and other seams will conform to it. There can be more than one marker seam. There is also a hierarchy for conformance, so if the main marker seam is not present, then the next marker seam in line will prevail.

Calculate Strata Pinchout and slide bar: This setting determines if the thickness of a seam is pinchout when it does not occur in a drillhole. Turn it on to activate pinchout. If a seam is not present, it will pinch it out using that drillhole. If it is off, it will carry the seam through the hole where the seam is not encountered. The slide bar determines the distance between the drillholes for pinchout. Near zero will pinch the seam closer to the hole where it does not appear. Non-zero will pinch the seam closer to the drillhole where it does appear. Most of the time, the best "guess" is to leave it in the middle, where it will pinch the seam half way between the holes. It is also recommended to have the pinchout turned on when making thickness grids. This will model the thickness properly. But, when modeling the bottom elevation of a seam, turn OFF pinchout. If it is on, many times it will bring the elevation of the seam up to the next seam to pinch it out. Turning the off for elevation grids will keep them down where they belong. Then just add the thickness and the bottom elevation to obtain the roof elevation grid.

Process Only Strata with Beds: This setting is used mostly when duplicate strata appear in a drillhole. It will only model with strata that have a bed name, ignoring those that don't. This useful in a situation where only the KEY strata have a bed name. It will ignore all the NONKEY strata, and just model the KEY strata. This can be used when modeling geology such as lignite or bentonite, where thin seams have bed names and the overburden, partings and interburdens do not.

Prompt for Advancement Pline for Quantities: When running the quantity routines in the standard mining module, turning this on will prompt for the Advancement pline for quantities.

Composite Bed Qualities by Density: When modeling the quality attributes from drillholes, and they are sampled at multiple intervals, by default, they are averaged by thickness and that one value will be used for griding. This option will weight the quality attribute by a Density value instead of thickness. the Density attribute needs to be in each drillhole and the name is entered in the box to the right. It is usually DENSITY, and is in pounds per cu. ft or kg/cu m.

Use Strata Limit Lines: When using Strata Limit Polylines for modeling, this needs to be turned on or the program will not use them, even if they are on screen. If just this one is on, then you will be prompted to select them for all commands.

Auto Select All Strata Limit Lines: Turning this on will automatically select all the Strata Limit Polylines for all commands that use them. They will not have to be selected each time.

Use 0 Values for Blank Entries in Coal Sections: When using the Coal Sections in the standard mining module, if a value is blank, this option will assign a 0 value instead of a blank or Null value.

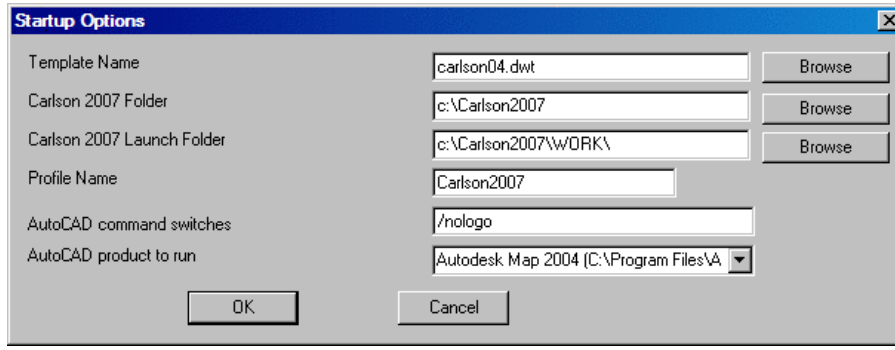
Report Format for Quantities by Avg/Grid Methods: This setting determines the report format from the quantity commands in the standard mining module. Standard is the regular text editor. Column puts them in columns in the editor and Formatter will use the powerful Report Formatter.

Key Material Name: This is the name of the KEY material you are mining. Enter in COAL or LIMESTONE or GOLD, or whatever ore you are mining.

Include Strata Name in Bed Composite: This will add the strata name to the bed name when running the bed composite commands, such as Split Bed by Parameters.

Startup Options:

These options are used for starting Carlson. Defaults are set here, and will be used at the beginning of each session.



Template Name: This is the drawing template file that will be used when starting a new drawing. The Browse button allows for selecting a new file.

Carlson 2007 Folder: This is the folder where Carlson is installed. The Browse button allows for selecting a new file.

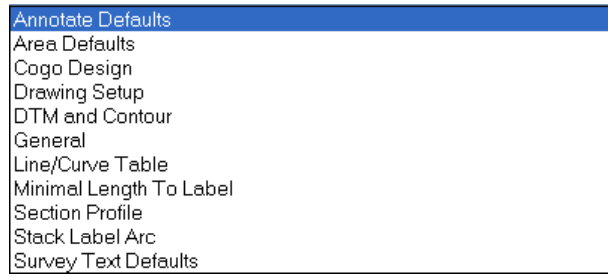
Carlson 2007 Launch Folder: This is the folder where Carlson will initially look for, and save a drawing file. The Browse button allows for selecting a new file.

Profile Name: This is the AutoCAD Profile that will be used when working in Carlson and AutoCAD.

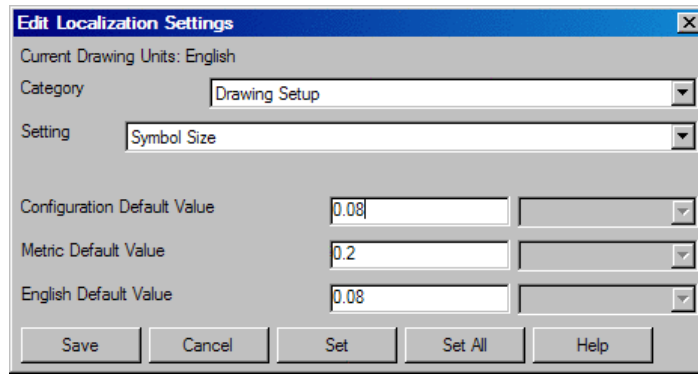
AutoCAD command switches: This turns off the AutoCAD "splash" screen upon launching the program. The /nologo takes the splash screen out of the start up procedure.

AutoCAD product to run: This is the AutoCAD version and flavor (Map or LDT, etc.) that Carlson is installed for, and will run with.

Localization Options:
There are literally hundreds of default settings that can be set with this dialog. The categories that can be selected from are:



The Settings for each Category will display all of the items that can be setup for default values. The Default value is set in the Configuration Default Value box. The corresponding Metric or English default values are set here, allowing for easy switching between the two systems.



Pulldown Menu Location: Settings
Keyboard Command: config_scad
Prerequisite: None
File Names: \lsp\survini.lsp, \lsp\cogoini.lsp, \lsp\dtmini.lsp, \lsp\mineini.lsp, \lsp\hydroini.lsp \lsp\sctini.lsp, \lsp\cfg_scad.lsp, \lsp\cfg_scad.dcl

Edit Symbol Library

Function

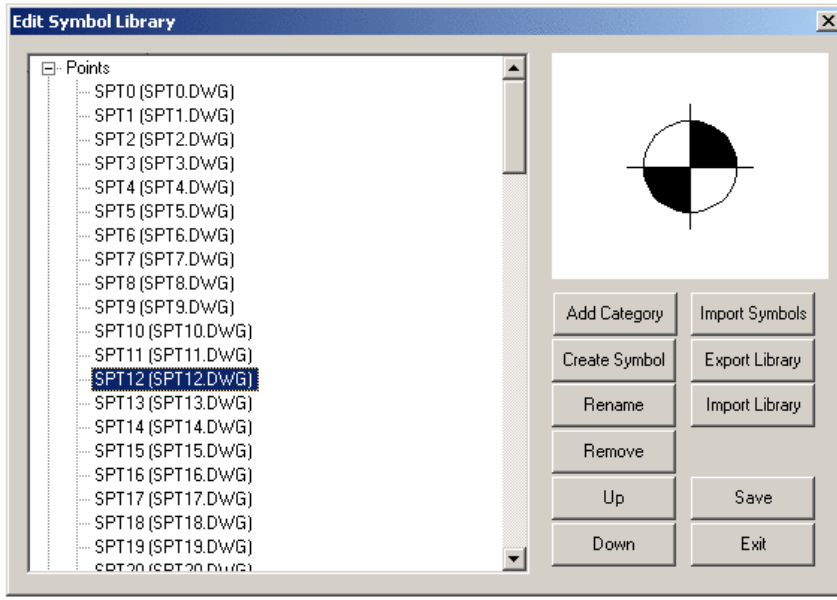
This command allows you to customize the symbol library.

Categories are a way for grouping symbols by type for your own convenience in symbol selection. A new category is added by clicking on the "Add Category" button. An edit field then appears in the tree view on the left and waits for you to enter the category name. The input is finished by pressing the Enter key.

The category may be populated by creating a new symbol from selected entities in the drawing, by specifying drawing (.DWG) files, or by moving existing symbols from one category to another.

To create a new symbol, open a drawing which has the entities to be used in the symbol. The symbol should be drawn at unit size (scale 1:1) because Carlson will scale the symbol by the current drawing scale when the symbol is used. Highlight the category for the symbol and click on the "Create Symbol" button. A dialog appears for entering the new symbol name. Next, specify the file name for the symbol. The file name has a .DWG extension and would usually reside in the Carlson SUP directory, but you may use another path. Then the program will prompt you to select the entities from the drawing for the symbol. An insertion point for the symbol must also be picked.

The "Import Symbols" button brings up a file selection dialog which allows you to select multiple files to be added to the current category (to select multiple files use Shift or Control keys along with the mouse). If the files you select are not in the Carlson SUP directory, the program will offer an option of copying them there. There are also Import Library and Export Library buttons.



By default, the symbol description is the same as file name. The description for the symbol or category name may be changed by highlighting that name and clicking on "Rename" button, the name being edited is then placed into edit mode. To move a symbol into a different category, select the symbol to be moved on the tree and click an "Up" or "Down" button as many times a needed to reach the desired category. The symbols are sorted alphabetically within each category, while categories are remaining in the order placed to allow the more frequently accessed categories be on top.

Note: The symbol library is stored in an ASCII file named symbols.dta in the Carlson \USER directory.

Pulldown Menu Location: Settings
Keyboard Command: editptsym
Prerequisite: None
File Names: \lsp\scadutil.arx, \user\symbols.dta

Quick Keys

Function

Quick Keys can provide an enormous time savings on initiating keyboard commands. One frustration of using AutoCAD is when your command initialization cannot keep up with your train of

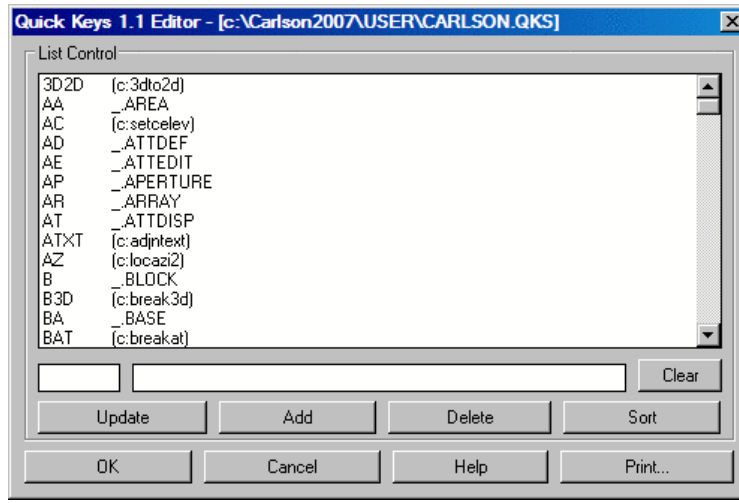
thought, and you are constantly seeking the fastest way to initiate commands. Quick Keys provides numerous command aliases that are already set up for you, which you can customize easily. You can also add any new commands quickly and easily using the Quick Keys editor, without leaving AutoCAD. The Quick Keys are so productive, that even dedicated menu users appreciate and use them.

The Quick Keys Editor can be broken down into areas. The list box at the top of the screen, edit fields, list control buttons, and program control buttons. Each area and button is explained below.

List Control contains a list of the loaded quick keys. There are usually more items than will display on the list box. Use the scroll bar to move up and down through the list. Picking on an item in the list box makes it the current item, which can be affected by nearly all edit commands explained below.

When an item on the list box is picked, its record is displayed in the **Edit Fields.** Each record item consists of up to a 5 character quick key (the portion typed in at the AutoCAD command line), and a long command or AutoLISP expression. Note that if you are adding a shortcut to a lisp function, you must use the following syntax: (C:FUNC) where FUNC is the command name. There are several examples of this included with Quick Keys.

If you intend to make changes in an item, use standard editing procedures, including the use of arrow keys along with the tab key and/or pointer movements to make changes. Once changes to a key have been made, you must use the **Update** or **Add** options explained below. Pressing enter on either field will have no effect on the item in the list. Choosing the CLEAR button at the end of the edit fields erases the contents of both edit fields allowing you to enter new fields not based on existing records. However, it is fairly efficient to select an item that has nearly what you need in a command, make changes, then add the modified record as a new item.



Changes made to items are not automatically changed in the list, you must use the UPDATE or ADD button to record changes to be saved.

When changes have been made to an existing record, the **Update** button must be pressed to make the changes effective in the list. Pressing enter on the edit fields do not record changes. After the changes are made the item will remain the highlighted item in the list.

When a new item has been created in the edit fields, you must click the **Add** button to add the item to the list. Pressing enter on the edit fields do not add new items. The newly added item will appear at the bottom of the list and will be highlighted.

Highlight the item you wish to delete in the list box, then press the **Delete** button to remove it fromthe list. In the event you accidentally delete items, simply choose Cancel to exit without saving changes.

At any time during processing of Quick Keys (except during a UPDATE or ADD operation), you may choose the **Sort** button to sort the list of Quick Keys. The most common use of sort will be after adding several new items to the list.

The buttons on the bottom row are used to control files. Changes made to the Quick Keys table are stored when exiting the dialog with the OK button. The original key definition file supplied is called Carlson.QKS. However, when you make changes for the first time and use the OK button to exit the dialog, the program writes changes to a file called CUSTOM.QKS. The Quick Keys editor looks for the existence of the file CUSTOM.QKS when loading, and will use this file when available. This approach will shelter your (CUSTOM.QKS) from overwrites if you reinstall

Carlson.

When all changes are complete, choose the **OK** button to save changes, which will automatically build and load the run time file. Any Quick Keys added or updated will be immediately available at the command prompt. However, if a key definition was deleted, it will not be removed from memory until another drawing is loaded or you begin a new drawing.

The **Cancel** button exits the Quick Keys dialog without making any changes to your system.

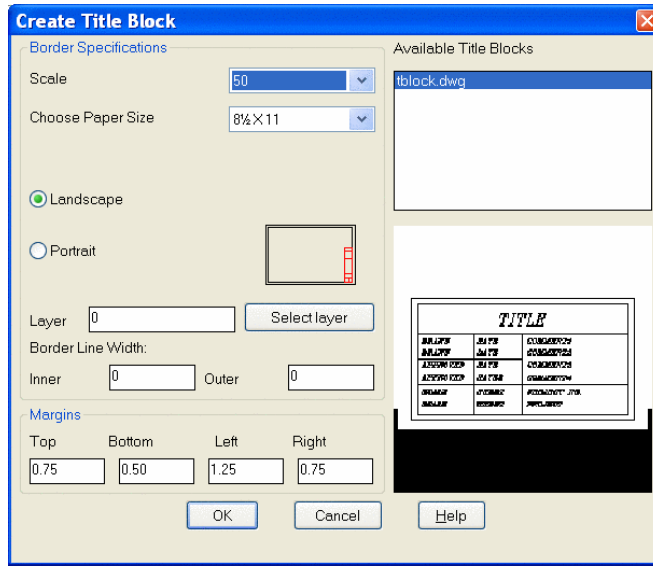
This **Print** option is used to obtain a printed list of the Quick Keys currently loaded. First consider sorting the list, then use this option and enter a filename. The program will write the list to a file that can be brought into any editor or word processor, then printed.

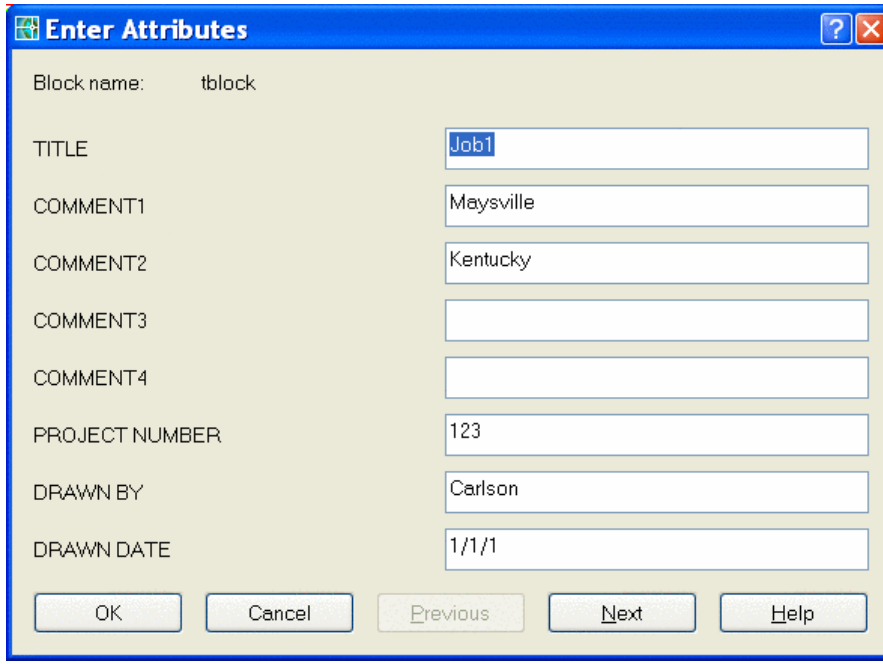
Pulldown Menu Location: Settings
Keyboard Command: quickkey
Prerequisite: None
File Name: \lsp\quickkey.lsp

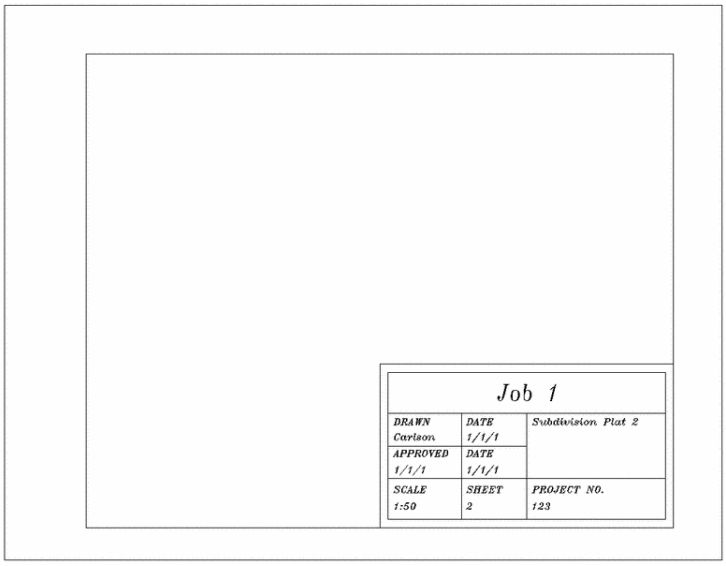
Title Block

Function

This command draws a border and title block for the selected sheet size. At the top of the dialog, choose your horizontal scale and sheet size. The ∗other∗ choice at the bottom of each list will allow you to add your own scale or size if yours is not listed. Anything added to these lists will be retained for future use. Next, choose either "landscape" or "portrait" format. A blue rectangle next to this choice shows you the difference. Below this, you can choose what layer to draw the border and title block on. The margins to use are specified next at the bottom of the dialog. On the right hand side of the dialog. you can choose from several title blocks. As you choose each one, a preview will be shown below this list. This routine looks for all drawings named "tblock" in the \SUP directory. If you want to add your own title block, simply create a new drawing (or copy an existing one) in the \SUP directory and give it a name that starts with tblock. Example: tblock22.dwg and tblock-Jones.dwg are both valid names for this routine, but "MyTitleblk.dwg" is not. After you have made all your decisions in the dialog box, press OK. Depending on your current zoom level, your drawing may be zoomed out to allow you to see the entire area that will be covered by the drawing border. At this point, you have the border attached to your cursor and it is waiting for you to pick a point for insertion. As soon as you do this, a secondary dialog will appear for you to fill out the attributes associated with the particular title block you selected.


Create Title Block
Border Specifications
Scale
50
Choose Paper Size
8½×11
Landscape
Portrait
Layer
0
Select layer
Border Line Width:
Inner
0
Outer
0
Margins
Top
Bottom
Left
Right
0.75
0.50
1.25
0.75
OK
Cancel
Help
Available Title Blocks
tblock.dwg
TITLE


Enter Attributes
Block name: tblock
TITLE
Job1
COMMENT1
Maysville
COMMENT2
Kentucky
COMMENT3
COMMENT4
PROJECT NUMBER
123
DRAWN BY
Carlson
DRAWN DATE
1/1/1
OK
Cancel
Previous
Next
Help



Pulldown Menu Location: Settings
Keyboard Command: tblock
Prerequisite: Set horizontal scale in Drawing Setup
File Names: \lsp\title.lsp, \lsp\title2.fas, \sup\tblock*.dwg(s)

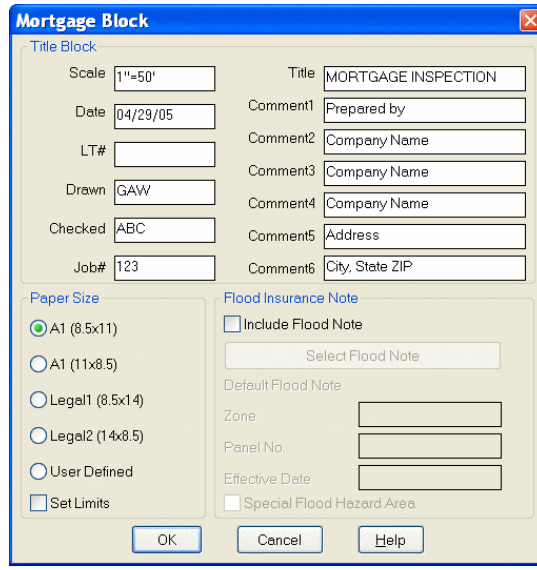
Mortgage Block

Function

This command draws a personalized title block for a mortgage survey. You may select an $8\frac{1}{2}$" x 11" sheet, an $8\frac{1}{2}$" x 14" sheet, or define your own sheet size. The dialog box allows the user to edit all block information and input unique data for every layout. The mortgage block drawing is called from the *mortgage.dwg* file located in the *\sup* directory and can be easily opened and edited within AutoCAD, allowing for the user to alter the size, text, or any other aspect of the drawing to fit the user's particular needs. However, this is usually unnecessary since the original *.dwg* file places this block for a standard 8 $\frac{1}{2}$ x 11 ratio drawing. In addition to the block, the user can include the inputs and prescribed text for a Flood Note, which is placed in the bottom left hand corner of the drawing. You may also select a custom drawing file for your flood note. All inputs are saved and recalled from a *mortgage.ini* file located in the *\User* directory.

The *LIMITS* of the drawing can be set to the lower left and upper right corners of the border. After the title block is drawn, the contents can be edited using the *Attribute Edit* command under the

Edit menu.



Pulldown Menu Location: Settings
Keyboard Command: mortgage
Prerequisite: Set horizontal scale in *Drawing Setup*
File Names: \lsp\mortgage.lsp, \sup\mortgage.dwg

Set/Reset X-Hairs

Function

Set X-Hairs sets the crosshairs either to align with the selected line or polyline or to a user-specified slope. *Reset X-Hairs* restores the crosshairs alignment to horizontal.

Pulldown Menu Location: Settings > Crosshairs
Keyboard Commands: setxhairs, resetxhairs
Prerequisite: Line entity
File Names: \lsp\xh.lsp, \lsp\rh.lsp

Save/Load Tablet Calibration

Function

A common problem with calibrating maps on a large format digitizer is that if you leave the current drawing session, AutoCAD forgets the tablet calibration. Tablet save can be used to save the calibration when a drawing is taped down properly. This calibration file can be restored at any time later and be accurate so long as the drawing did not move on the tablet.

Save Configuration Procedure:
1) Command: TABSAVE
2) Designate filename (∗.TCF) to save configuration into.

Restore Configuration Procedure:
1) Command: TABREST
2) Select filename (∗.TCF) to restore configuration from.

Pulldown Menu Location: Settings > Tablet Calibration
Keyboard Commands: tablet1, tablet2
Prerequisite: None
File Name: \lsp\tablet.lsp

Create AutoCAD Icon

Function

This command will create an icon on your desktop to launch plain AutoCAD.

Many people assume that the stock AutoCAD icon will launch plain AutoCAD. This is not always true. The problem occurs because, if no profile is specified, AutoCAD always starts with the last used profile. If you run Carlson, then exit and then execute the stock AutoCAD icon (which does not specify a profile), Carlson loads anyway.

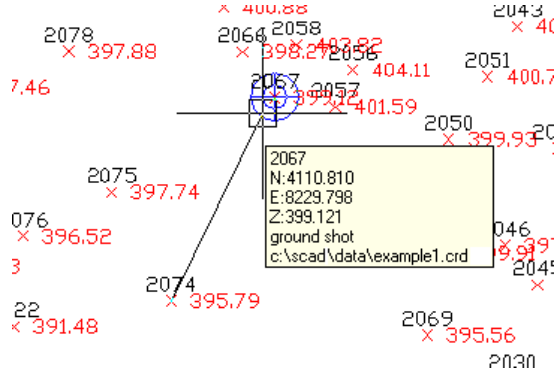
When you run this command, an AutoCAD profile called Vanilla is created, and an AutoCAD icon is created on the desktop that specifies this startup profile.

Technical Note: In its attempt to create the vanilla profile, this routine removes references to Carlson from the support file search path, and replaces the Carlson menu with the stock AutoCAD menu. If the program cannot locate the AutoCAD menu (due to it being deleted or moved), you may have to create the icon manually, as outlined in the Carlson Software Knowledge Base online.

Point Object Snap

Function

When this toggle is turned on, you can move your cursor near a Carlson point and snap to the actual coordinates of the point without having to use the AutoCAD *NODE* snap. Point Object Snap can be used alone to display the point information or it can be turned on and used during other commands. In the example illustration, the *2DP* command (2D polyline) has been started and the first point picked was point number 2074. As the cursor nears point number 2067, the point snap marker appears and the point information is displayed, click the mouse and the next polyline vertex will snap to the coordinates of point 2067.

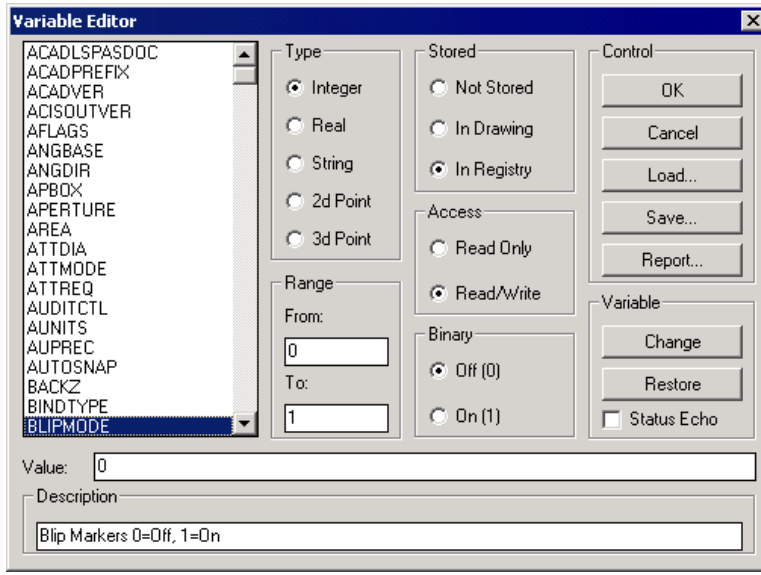


Pulldown Menu Location: Settings
Keyboard Command: 'pointsnap
Prerequisite: None
File Name: \lsp\scadutil.arx

System Variable Editor

Function

The AutoCAD engine stores the values for its operating environment and some of its commands in system variables. Each system variable has an associated type: integer, real, point, switch, or text string. This command allows you to list or change the values of system variables.



• **List Box**: Contains a list of the variables associated with the currently running version of AutoCAD. There are more items than will display on the list box, use the scroll bar to move up and down through the list. Picking on an item in the list box makes it the current item, causing the information about the item to be displayed, and can be affected by most of the edit commands explained below.

• **Edit Field**: When an item on the list box is picked, its current setting is displayed in the edit field. If you intend to make changes in an item, use standard editing procedures including the use of arrow keys and/or pointer movements to make changes. Once changes have been made, you must use the CHANGE options explained below to effect changes. Pressing enter at the edit field will have no effect on the item in the list. If the item selected is a read-only variable, the edit field will be grayed-out and will not allow input.

• **Description**: When an item on the list box is picked, its definition is referenced and displayed in this field. This can be a benefit in learning the uses of the assorted system variables. This is a display only field, so you can't change the description given.

Under Type Group, the type of variable will be displayed indicated by one of the radio buttons. Each of these types are explained below for your benefit. For additional information on variable types used by AutoCAD, obtain and consult a source of AutoCAD documentation.

• **Integer**: Defined as a whole number in the range from -32767 to +32768, no decimal value accepted.

• **Real**: Defined as a real number in the range from -1.797E+308 to +1.797E+308, with extreme

decimal accuracy maintained.. Some real variables have a smaller range than previously stated.

- **String**: Defined as a sequential array of characters in the range from 0 to 65535 characters, with a range of ASCII (0-255). Numbers can be included in strings, even though they have no mathematical significance.

- **2D Point**: Defined as a list of two real numbers in the range from -1.797E+308 to +1.797E+308 separated by a comma, having extreme decimal accuracy maintained. Always maintain the X,Y format, one (and only one) comma must be used, separating the X and Y.

- **3D Point**: Defined as a list of three real numbers in the range from -1.797E+308 to +1.797E+308 separated by commas. While editing a 3D point, you must always maintain the X,Y,Z format, two (no less or no more), commas must used, separating the X and Y and Z values.

Under Range Group, the variable displayed will usually have a range displayed. The FROM value indicating the minimum, and the TO value being the maximum value accepted.

Under the Store Group, depending on the type of variable, AutoCAD may store the value in the drawing or the configuration file, or it may not be stored. Each of these types are explained below for your benefit.

- **Not Stored**: Some variables, such as PLATFORM and CDATE, are not stored because they are system interdependent.

- **In Drawing**: Most variables are stored in the drawing, making the drawing format more personal than just a database of objects. This allows you to open a drawing and have it behave just as though you had never left it.

- **In Config**: These are variables that remain the same regardless of the drawing opened. APERTURE and PICKBOX are just two examples of variables stored in the configuration file.

Under Access Group, depending on the type of variable, AutoCAD may not allow you to make changes to it. Each of these types are explained below.

- **Read Only**: Some variables, such as PLATFORM and CDATE, are read-only and therefore cannot be changed. Read-Only variables are marked and the edit field will be grayed indicating that you can't change the variable.

- **Read/Write**: Most variables are read/write and can be changed. These variables are marked and the edit field will be active so you can change the variable.

Under Binary Group, depending on the type of variable, the value may be off or on, yes or no. If the variable type is not binary, this group will be grayed out entirely.

- **Off (0)**: Indicate an off condition. Some variables, such as ATTREQ, are simply on or off toggles. You may change a binary item by clicking in this group to change the variable, or

changing the value in the edit field.

- **On (1)**: Indicate an on condition. Binary variables are simply on or off toggles. Their range is from 0 to 1. You may change a binary item by clicking to change the variable, or changing the value in the edit field.

Control Buttons - These buttons are the main controls in the use of the Variable Editor. Each buttons purpose is explained below.

- **OK**: Used to accept the changes made during the variable editing process, returning you to the command prompt with changes in effect.

- **Cancel**: Used to cancel the changes made during the variable editing process, returning you to the command prompt without the changes in effect.

- **Load**: Used to load a saved set of system variables. This allows you to create a drawing, save the system variables, open a second drawing, and load those variables into that drawing. Read-only variables are skipped.

- **Save**: Used to save the current system variables to a disk file. All system variables are stored to the file, even those that are marked as read-only.

- **Print**: Used to print the current system variables. After choosing this option, you will prompted for an output filename, then the program will proceed to write the system variables to the file. This file can be loaded into any editor or word processor, edited and printed.

Variable Buttons - These buttons are used to control the changes in variables, while using the Variable Editor. Each buttons purpose is explained below.

- **Change**: Used to execute the changes typed into the edit field. You must use this button, simply pressing enter will not make the change.

- **Restore**: Used to cancel the changes typed into the edit field. If you make a mistake or change your mind while making changes in the edit field, press this button to restore the edit field to the value before editing.

- **Status**: Used to determine if the program will echo the status of changes being made to the command area. If this toggle is on, any changes made from the dialog will echo the change. Also if a stream of change commands is being read from a file, and the toggle is on, the changes taking place will be displayed.

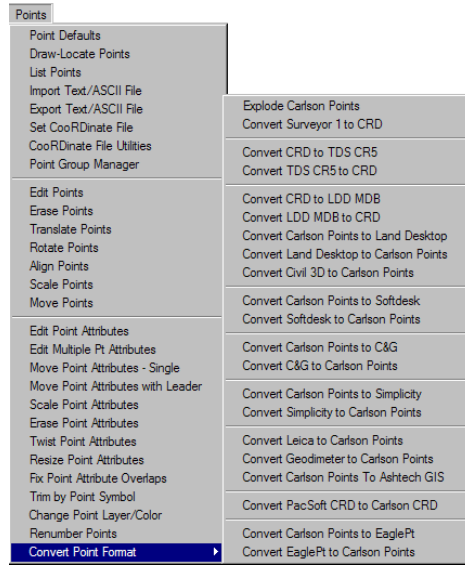
Note: This command displays many more system variables than are found in the Systems Variable Chapter, which contains a list of **supported** system variables. Modification of any system variable other than the supported ones found in the Systems Variable Chapter is done at your own risk, and may result in program errors requiring a re-installation of Carlson.

Pulldown Menu Location: Settings
Keyboard Command: VAREDIT
Prerequisite: None

Points Menu

All of the routines in this menu operate on points in a Carlson coordinate (.CRD) file. Coordinate (.CRD) files are binary files that contain point numbers, northings, eastings, elevations and descriptions. Alternately, C&G CRD & CGC files, LandDesktop MDB files or Simplicity Systems ZAK files can be used in place of the Carlson CRD file. All routines in this menu will read from, and write to, these types of point data files. At any given time, there can only be one (1) coordinate (.CRD) file set current. If a command is initiated that requires a coordinate (.CRD) file, and there is not one set, Carlson will prompt for a coordinate (.CRD) file name. From that point on, this is the current coordinate (.CRD) file. Another coordinate file can be used by choosing *Set Coordinate File*, or Open CRD File in *Coordinate File Utilities.*

Whenever asked for point numbers you can enter any combination with commas and dashes or *All* to use all points. For example 1-3,7,20-23 would use 1,2,3,7,20,21,22,23. Coordinate files have either numeric or alphanumeric point numbers. Alphanumeric point numbers consist of nine or less digits and letters (i.e. point# 7A). The type of point number format is set when the coordinate file is created. This setting is found under General Settings in *Configure.* This setting only affects new coordinate files.



Each point is drawn by three entities: point block, point node and symbol. The point block is an AutoCAD INSERT entity with PNTNO, PNTELEV and PNTDESC attributes. These attributes represent the point number, elevation and description respectively. The point node is an AutoCAD POINT entity and is used for picking the point with the NODE snap. The point node is also used as the X, Y, Z coordinate in surface modeling in the Civil Design module. The symbol can be any symbol defined in the Symbol Library. (Use SPT0 for no symbol). Since points use Carlson point symbols, the AutoCAD system variables PDMODE and PDSIZE should usually be set to 0.

Point Links

The points in the drawing can be linked to their coordinates in the coordinate file. The link updates the coordinate file when a point is modified in the drawing. For example, when points are moved with the AutoCAD *Rotate* command, their coordinates will be automatically updated in the coordinate file. To update the coordinate file without this automatic link, you can run the command *Update CRD File from Drawing* in *Coordinate File Utilities.* This option is called *Link Points with Coordinate File* and can be set in *Configure* under General Settings. This setting does not affect points currently in your drawing, only points drawn after you change this setting.

Point Notes

Each point in the coordinate file has room for a 32 character description. To have a longer description, an associated point note file can be used. The note file has the same file name as the coordinate file with a .NOT extension and is stored in the same directory. For example, survey.not would be the note file for survey.crd. The note file is a text file that stores a point number together with the additional description for the point. There is no limit to the length of the note. Notes can be added to points using the command *Input-Edit Point* found in *Coordinate File Utilities.* The *List Points* command can be used to print out the notes.

Point Entity Grouping

For each point, the point attribute block, node, and symbol can be bound together. This means that if you choose to use the Move command (or other AutoCAD tools) the entire collection moves together. This is done using the grouping functionality in AutoCAD.

To disable this system altogether, go to *Configure*, choose General Settings, and turn off the toggle for Group Point Entities. If you need to temporarily disable grouping in a drawing, you can use the AutoCAD toggle for grouping, which is Ctrl-A. Holding down the Ctrl key and pressing the letter A on the keyboard activates this two way toggle, with the current status echoed to the command prompt area.

Extended Point Information

Carlson points include additional information on each element that makes up the point collection (attribute block, node and symbol). This information allows Carlson to know such things as which coordinate (.CRD) the point came from. Commands like *Drawing Inspector* can then display the point information for the point entities. This also makes it easier for Carlson to identify which AutoCAD objects belong to a point, making commands like *Edit Point Attributes* a single pick instead of a selection set.

Point Defaults

Function

This command sets Carlson point options.

Descriptions: Specify whether you are prompted for a point description when creating points and whether the point descriptions are labeled in the point block.

Elevations: Specify whether you are prompted for a point elevations when creating points and whether the point elevations are labeled in the point block.

Locate on Real Z Axis: When checked, points are located at their actual elevation, otherwise points will be located zero elevation.

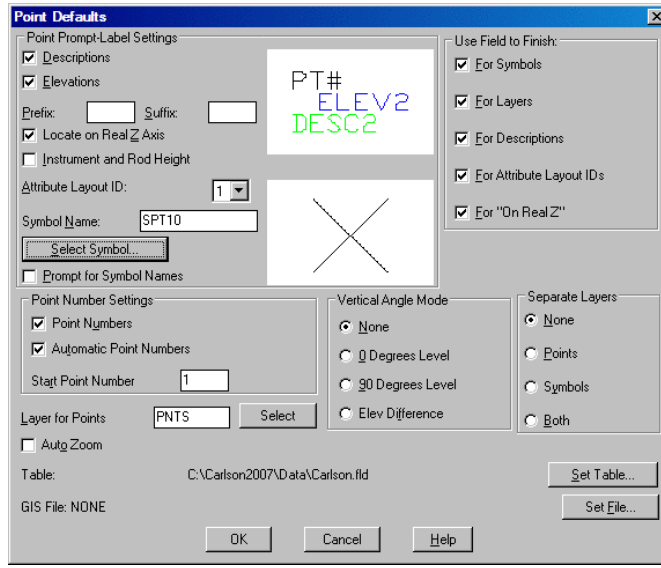
Attribute Layout ID: Controls the location of the point number, elevation and description. These attribute layouts are defined in AutoCAD drawings that are stored in the Carlson SUP directory with the file name of SRVPNO plus the ID number (i.e. SRVPNO1.DWG, SRVPNO2.DWG, etc.). If you want to change the attribute positions for a layout ID, then open and edit the associated SRVPNO drawing.

Symbol Name: Enter the default symbol name to use. You may also pick the Select Symbol button to select a symbol from the symbol library.

Prompt for Symbol Names: When checked, you will be prompted for each symbol name instead of using the default symbol.

Point Numbers: When this toggle is OFF, no point number will be created and no points will be stored in the coordinate (.CRD) file.

Automatic Point Numbers: When this toggle is OFF, commands that locate a point will prompt for a point number. Otherwise, point numbers are numbered sequentially. If the Start Point Number field is set to 0, no point will be plotted. An exception to this is when you use the *Draw-Locate Points* command and use the Range option, then a point entity is plotted.



The following table illustrates the effects of elevation settings:

```
          Elevations Yes  Real Z No
Picked Point  Labels point, Prompts for elevation, uses 0 for z coordinate
Point Number  Labels point, No Prompt, uses 0 for z coordinate

          Elevations Yes  Real Z Yes
Picked Point  Labels point, Prompts for elevation for z coordinate
Point Number  Labels point, No Prompt, uses z coordinate from file

          Elevations No   Real Z No
Picked Point  No Label, No Prompt, uses 0 for z coordinate
Point Number  No Label, No Prompt, uses 0 for z coordinate

          Elevations No   Real Z Yes
Picked Point  Labels point, No Prompt, uses z coordinate of picked point
Point Number  Labels point, No Prompt, uses z coordinate from file
```

Start Point Number: Specify the next point number to use.

Vertical Angle Mode: Specify how Carlson should prompt you for vertical angles. None means no prompt. Applies to creating points with commands such as *Traverse.* The vertical angle is

used to calculate the point elevation.

Separate Layers: Specify settings for point attribute layers.

None: The point symbol, point number, elevation and description use the layer names PNTMARK, PNTNO, PNTELEV and PNTDESC.

Points: The point number, elevation and description layers are composed by concatenating the point layer and the string NO, ELEV, and DESC respectively. For example, if the point layer is UTIL then the attribute layers will be UTILNO, UTILELEV and UTILDESC.

Symbols: The point symbol layer is composed by concatenating the point layer and the string MARK. For example, if the point layer is UTIL then the symbol layer will be UTILMARK.

Both: The point symbol, point number, elevation and description layers are composed by concatenating the point layer and the string MARK, NO, ELEV, and DESC respectively. For example, if the point layer is UTIL then the symbol/attribute layers will be UTILMARK, UTILNO, UTILELEV and UTILDESC.

Layer for Points: Specify the layer name for Carlson points.

Auto Zoom: When checked, AutoCAD will perform a Zoom—Center around new points to keep the display centered around current working area. This only applies during commands such as Traverse. This setting is also available in *Configure* under General Settings where it is called Auto Zoom Center for New Points.

Use Field to Finish For: Allows you to use the code definitions from Field to Finish for the Point Symbols, Layers, Descriptions, Attribute Layout IDs and whether to locate the point on the "Real Z" and whether to Separate Attribute Layers when creating new points. For example, when creating a point with description "EP", Carlson would look up "EP" in the Field to Finish table and will use the field code definitions to establish the point instead of the definitions defined in Point Defaults.

GIS File: This option lets you specify a GIS file to be used when creating new points. The GIS file contains a list of fields to prompt for. For each point that is created, the program will prompt for these fields and store the results to the note file (.not) associated with the current CRD file.

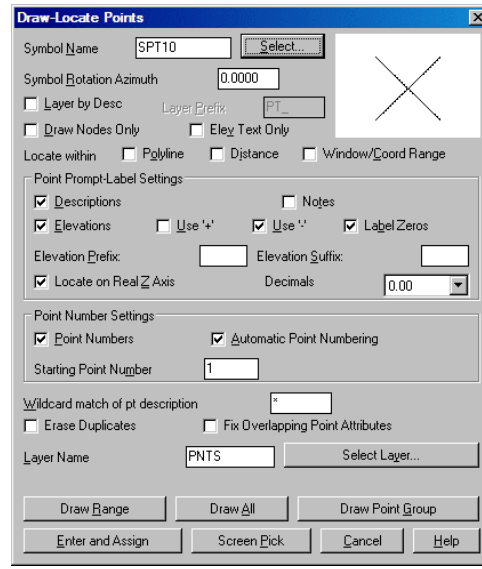
Pulldown Menu Location: Points
Keyboard Command: ptsetup
Prerequisite: None

File Names: \lsp\ptsetup.lsp, \lsp\scadenvr.dcl

Draw-Locate Points

Function

The Draw-Locate Points dialog box allows you to insert either new or existing points into the drawing. You can create new points either by picking points on the screen, or by entering northing and easting coordinates. You can also place existing points by entering point numbers which reference the current coordinate file. You are prompted to choose a coordinate file if no coordinate file is current.



The name of the symbol file is displayed in **Symbol Name.** You can choose a different symbol by clicking Select. The selected point symbol is displayed on the right.

Symbol Rotation Azimuth is the rotation angle that is used for the point symbols. This angle is used in a counter-clockwise direction relative to the current twist screen.

Layer by Desc inserts the points in the layer named by the point description. Using Layer by Desc organizes the points by description and allows for layer management. For example, you can use the Isolate Layers command to show only points on a certain layer. If you include an invalid

layer character in the description, the layer name stops at the bad character. A point description of "UP / 105" would use layer "UP", for example. The Layer Prefix is added to the beginning of the layer name. For example, a Layer Prefix of "PT_" and a point with the description "EP" would use the layer "PT_EP". Layer Prefix is optional. It allows all the point layers to be grouped.

Draw Nodes Only inserts only a point entity (the node) and not the point block and symbol. This option is most useful when you have a lot of points to insert, because inserting only the nodes is faster than inserting nodes with the point block and symbol. Commands such as Triangulate & Contour and Make 3D Grid File can use these points, and do not need the point block and symbol.

Selecting **Elev Text Only** draws text of the point elevation without the point block, symbol, or node. The decimal place of elevation text is placed at the northing and easting point location.

Locate within Polyline inserts only the points that are inside a closed polyline. The command prompts you to select a closed polyline. All the points in the current coordinate file are checked. Any points that are located within the closed polyline are drawn.

Locate within Distance inserts only the points that are within a specified distance from a reference point. The command asks you for the reference point and the search distance. All the points in the current coordinate file are checked. Any points that are located within the search distance of the reference point are drawn.

Locate within Window/Coord Range inserts only the points that are within the specified window or range of northing, easting, and elevation. The command prompts for the minimum and maximum northing, easting, and elevations. These values default to the actual minimum and maximum in the coordinate file. Then the command prompts for the point number range of points to check. The points that fall in both the point number range and the coordinate range are drawn.

Under Point Prompt-Label Settings, you determine attributes for which you will be prompted.

Descriptions determines whether you are prompted for descriptions for each point when creating new points. When you are placing both new and existing points, Descriptions determine whether this attribute is labeled with the point inserts.

Notes works with the note file (.not) associated with the current coordinate file. The note file contains unlimited point descriptions in addition to the fixed 32-character point descriptions in the coordinate file. When you create points with Notes on, the command will prompt for point notes to be stored with the point. When you draw existing points with Notes on, any notes for the points are drawn as text entities below the point description.

Elevations determines whether you are prompted for elevations for each point when creating new points. When you are placing both new and existing points, Elevations determine whether this

attribute is labeled with the point inserts.

Use '+' labels the positive elevations with a leading '+'. For example, "+159.43".

Use '-' labels the negative elevations with a leading '-'.

Locate on Real Z Axis determines if the points are placed at their elevations or at zero elevation.

Label Zeros will label points with zero elevation when the Elevations option is on. Otherwise only points with nonzero elevation will be labeled.

Under Point Number Settings, you determine how points will be numbered.

Point Numbers determines whether the complete point block is drawn or just the symbol and node. When you create new points with Point Numbers off, no points are stored in the current coordinate file, and only the point symbol and node are drawn. When you draw existing points with Point Numbers off, the point attribute block is not drawn and only the point symbol and node are drawn.

Automatic Point Numbering applies to creating new points. With this option active, the command will use the **Starting Point Number** for the first new point. The next point number is automatically incremented. Before storing the point, the command checks whether the point number is used. If the point number is used and point protect is on (set in the Coordinate File Utilities command), then the command will prompt for another point number or to overwrite the point. With Automatic Point Numbering off, the command will prompt for the point numbers.

Determine how the points are to be displayed and in what layer.

With **Wildcard match of pt description**, you can display only points with specific descriptions. This can be thought of as a filter. For example, entering IP would display only points that are labeled with the description IP, or Iron Pin. The default is the asterisk (*). This will display all points regardless of description.

Layer Name allows you to designate a layer for the points to be displayed. You can enter a new name or choose an existing layer by clicking **Select Layer**. A Carlson Survey point consists of a block insert with attributes, a point symbol, and a point entity. The point entity is used for picking the point by OSNAP Node in other commands. The block insert includes a point number, elevation, and description. These attributes are in the PNTMARK, PNTNO, PNTELEV, and PNTDESC layers. The points are also in an overall layer as specified in this dialog box. This layer setup allows you to freeze a group of points by the main layer name or freeze point attributes for all the points in the drawing. For example, freezing layer "PNTS" would freeze all the points in this layer. Freezing layer "PNTELEV" would freeze the point elevation attribute for all the points.

Draw Range will draw existing points from the current coordinate file. The Draw Range button will prompt for the point numbers to draw.

Draw All will draw all the points in the coordinate file, and then zoom the extents of the display to show the points.

Draw Point Group will draw a point group with settings that are established in the Point Group Manager.

Enter and Assign can be used to create new points using the point northing and easting.

Screen Pick allows you to create points by picking the point coordinate on the screen. For example, you could set the Object Snap to EndPoint and pick the end point of a building polyline to create a point at the building corner.

Prompts

To create a new point:
Draw-Locate dialog *choose Screen Pick*
Pick point to create: *pick a point*
Select/<Enter Point Elevation <0.00>>: *Enter elevation* Press S to select text to set elevation.
Enter Point Description <>: *Enter*
N: 5106.57 E: 4901.96 Z: 0.00
Enter/<Select text of elevation>: Select text entity that defines elevation of point.

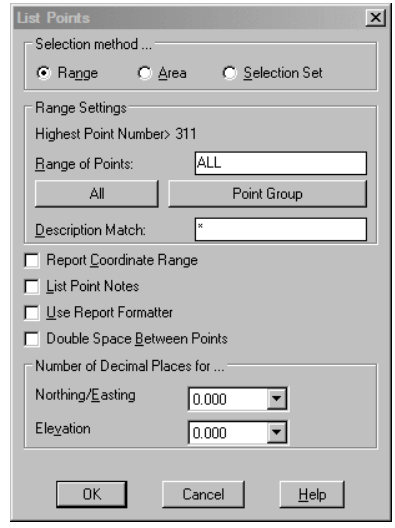
To locate a point in the coordinate file (point number 3 in this example):
Draw-Locate Point dialog *choose Draw Range*
Point numbers to draw: *3*
Points Drawn> 1
Locates point 3.
Point numbers to draw: *1-2*
Points Drawn> 2
Locates a range of points. From 1 to 2.
Point numbers to draw: *Enter*

Pulldown Menu Location: Points in all modules, COGO in the Survey module
Keyboard Commands: lpoint
Prerequisite: A CRD file and you may want to execute *Drawing Setup* (see the Setting menu) to set the scale and size.
File Names: \lsp\lp.lsp, \lsp\crdutil.arx

List Points

Function

This command generates a report of point numbers, northings, eastings, elevations and descriptions.



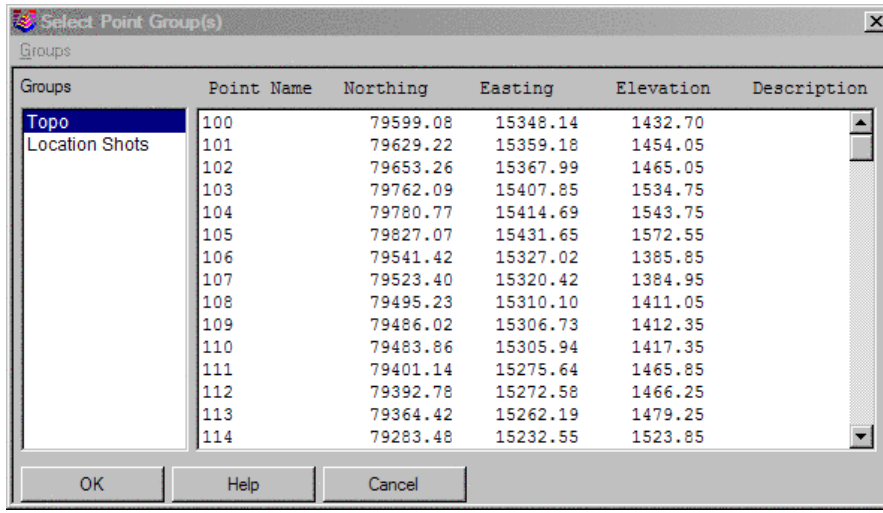
Selection Method-Range allows you to specify the points to list by point number range

Selection Method-Area allows you to select a closed polyline to list all of the points inside of that polyline.

Selection Method-Selection Set allows you to specify the points to list by selecting them from the drawing.

Range of Points: If you are using the Range method, specify the range of points to list here. To quickly specify all points, click the **All** button.

Point Group allows for the selection of a specified group or multiple groups for listing. Standard windows selection tools, ctrl and shift keys, can be utilized for selecting groups.



Description Match: Can be used to filter the point list. For example, entering "EP" for the Description Match would only list those points with a description of "EP". An asterisk (*) is the default setting, it matches any character sequence, meaning no filtering occurs.

Report Coordinate Range: When checked, the point list will include the minimum and maximum northing, easting and elevation.

List Point Notes: When checked, any additional point notes assigned to the points will be included in the point list. Point notes can be entered using the *Input-Edit Point* command found in *Coordinate File Utilities*.

Use Report Formatter: When checked, you may customize the fields and layout of the point report using the Report Formatter. The Report Formatter can also be used to export the point report to Excel or Access.

Double Space Between Points: When checked, the report will be double spaced.

The point list report is displayed in the Standard Report Viewer which can print, draw and save the report file. This report viewer cannot be used to edit the coordinate file. Instead use the *Edit Points* command in the Points menu.

Example of List Points Report:

```
 List Points Report
File> C:\Carlson2007\DATA\POINTS.CRD
```

```
Job Description>
Job Number> 0.000 Job Date> 06/01/2002
PointNo. Northing(Y) Easting(X) Elev(Z) Description
1        5355.240    5000.000   91.8    CP2
2        5000.000    5000.000   90.0    CP2
1000     5355.236    5000.000   91.8    CK
1001     4941.911    4622.029   91.4    FPC
1002     4952.629    4642.818   90.6    FH
1003     4959.931    4634.440   89.8    TOE1
```

Pulldown Menu Location: Points
Keyboard Command: listpt
Prerequisite: Points in a coordinate file or on the screen
File Name: \lsp\crdutil.arx

Import Text/ASCII File

Function

This command converts point data from an ASCII text file into the current Carlson coordinate (.CRD) file. Each line of the text file can contain any combination of point number, northing, easting, elevation and description. All point information should be on one line with the values separated by a comma, space or other delimiter. Under the Source File Format setting you can choose from some specific formats or User-Defined. For User-Defined, the format of the text file is specified in the Coordinate Order field where the value identifiers are listed with the appropriate delimiters. For example:

For a text file with northing, easting, elevation and comma delimiters:
5100.0,5150.5,485.1
5127.1,5190.3,487.3
The Coordinate Order would be:
Y X Z

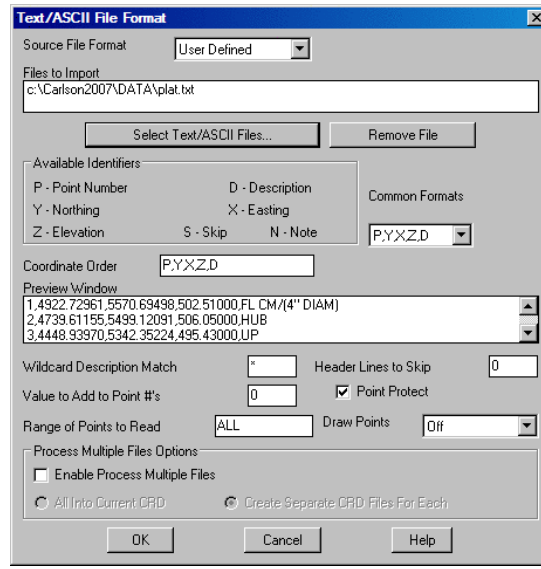
For a text file with point number, easting, northing, elevation, description and space delimiters:
1 5000.0 5000.0 490.3 TRAV
2 5030.4 4930.5 495.5 TRAV
The Coordinate Order would be:
P X Y Z D

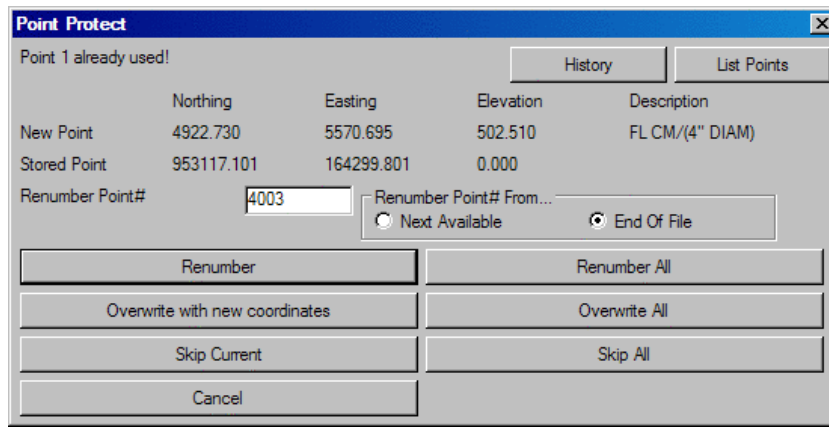
Common formats can be selected from the Common Format List. All the lines in the text file should contain only point data and any header lines should be removed. To read the text file, pick the Select Text/ASCII File button and choose the file to read. Then the selected file is displayed

in the Preview Window to help with filling out the Coordinate Order. When the Coordinate Order is set, click OK to read the text file. The Wild Card Descriptions Match allows for only point with matching descriptions to be imported. With Point Protect active, the program will check if a point number already exists in the CRD before importing the point. If a point conflict is found, you can either assign a new point number or overwrite the old point. The Value to Add to Point Numbers allows you to renumber the points as they are imported. The Header Lines to Skip value is the number of lines not to be processed at the start of the text file.

Multiple files can be imported at once. To do this toggle on the Enable Process Multiple Files option. After selecting the Text/ASCII Files button, you can select multiple files by using the Shift or Ctrl keys while picking files. You can also run Select Text/ASCII Files multiple times allowing for selection of files located in different locations. The files to import are listed in the top scroll display window. The point data from all the import files can be stored to the current CRD file or to separate files for each import file. The separate file option will name the resulting CRD files with the same name as the import file with a .CRD file extension. For example, the import file job125.txt would create job125.crd. The CRD file will be created in the same location as that of the selected text file to import.

The special formats of Leica .gsi files, TDS .cr5 files, Geodimeter .obs/.raw files, Laser Atlanta .txt files, Trimble .pos files, Zeiss .txt files, Traverse PC .trv files, Maptech, Benchmark .dat files and Cadvantage .cog files can be directly imported by choosing that File Format at the top of the dialog.



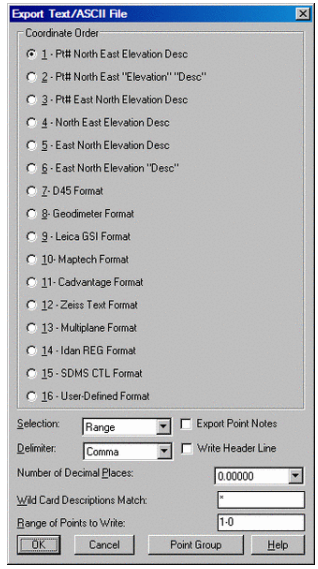


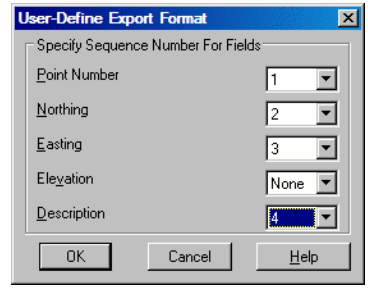
Pulldown Menu Location: Points
Keyboard Command: readpt
Prerequisite: A text file to read
File Name: \lsp\crdutil.arx

Export Text/ASCII File

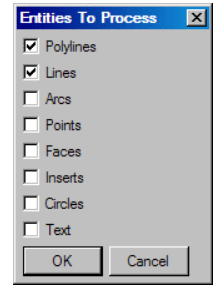
Function

This command outputs point data from the current Carlson coordinate file to an ASCII text file. Specify the type of file to write with the Coordinate Order radio buttons. There are several variations on point number, northing, easting, elevation and descriptions as well as specific formats for Leica, Geodimeter, Zeiss, Maptech, D45, Cadvantage, Multiplane and SDMS CTL formats. In addition there is an option, User-Defined Format, to define the order of the fields output. When using the User-Defined format, after selecting OK, the User-Define Export Format dialog will appear.On this dialog, specify the order of the fields by defining a number sequence in each field. You can skip fields and omit data in the output file by leaving None in the sequence field for this data.





Specify the Delimiter of the export file as either Comma or Space in the Delimiter field. There are three Selection Methods provided for the data to export. Specify either Range, Screen Points or Screen Entities in the Selection Field. A Range selection is a user specified range such as 1-10,30-50. A Screen Points selection is made by selecting points from the screen area. The Screen Entities option allows for selection of polylines, lines, arcs, points, faces, inserts and text to export point data from. When the Screen Entities option is selected, the following dialog box will display allowing for the specification of the type of entity to export data from.



A description filter is also available for exporting only points from the range or selection set with certain descriptions. After selecting the OK button, another dialog appears that allows you to specify a new text?ASCII file or to append data into an existing file. The standard file selection dialog allows you to specify the export file name.

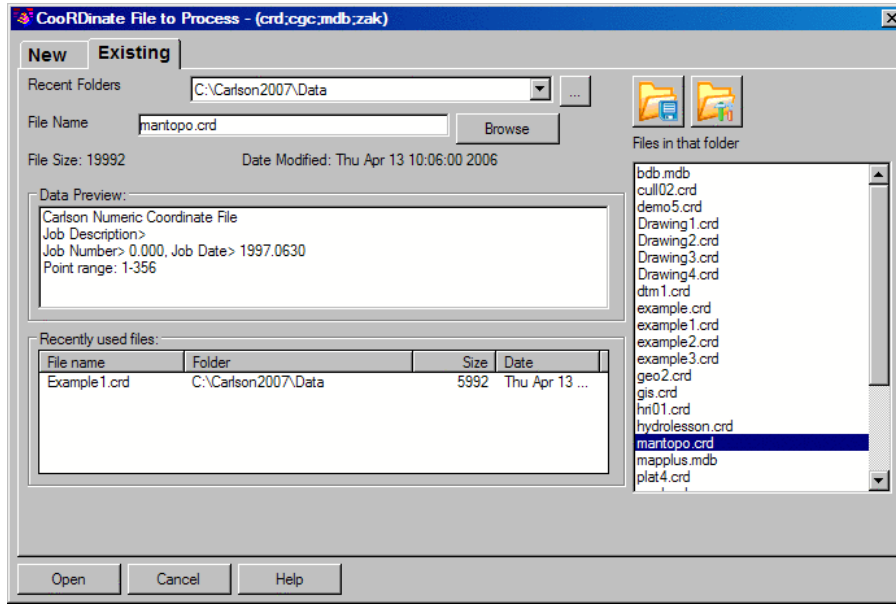
Pulldown Menu Location: Points
Keyboard Command: writept
Prerequisite: A Coordinate File (.CRD)
File Name: \lsp\crdutil.arx

Set Coordinate File

Function

This command allows the user to set the name of the active coordinate file. This file is used by different commands that compute, store and recall point coordinates. Carlson coordinate (.CRD) files are binary files that contain point numbers, northings, eastings, elevations and descriptions. Alternately, C&G CRD & CGC files, LandDesktop MDB files or Simplicity Systems ZAK files can be used in place of the Carlson CRD file. These files are stored by default in the configured data subdirectory. When prompted for the name, if you type in a path name the file will be stored in the specified path. If you don't specify a path then the default path that is configured in the *Configure* command, found under Settings, will be used.

When executed, the command defaults to the Existing tab for selection of an existing file. You may select a file from the list of Recent Folders, or choose the Browse button to go to a specific location on your computer. To create a new file, select the New tab and enter the name of the file in the file name field provided. Use the Browse button to specify the desired location to save the file.

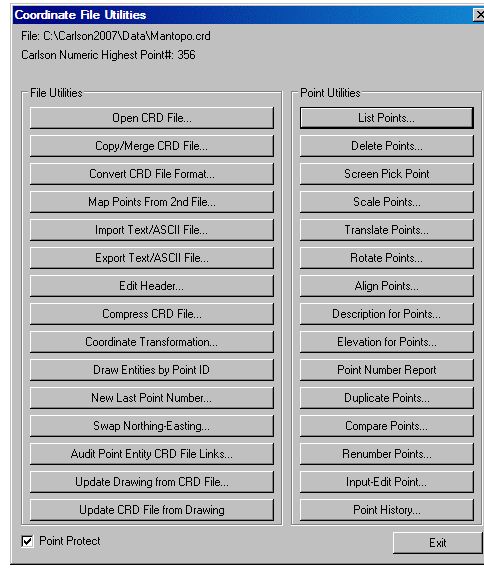


Pulldown Menu Location: Points
Keyboard Command: setcrd
Prerequisite: None
File Names: \lsp\pcrdfile.lsp, \lsp\scadfile.dcl

CooRDinate File Utilities

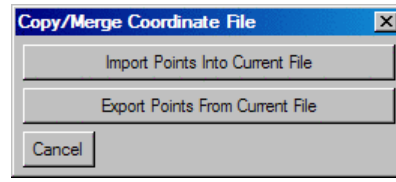
Function

This command allows you to manipulate the coordinates stored in a coordinate (.CRD) file. One of the most important commands is the Update CRD File from Drawing which allows you to update the file after editing the drawing with commands such as *Erase*, *Move, Rotate* or *Change Elevations*. Another handy option is the *Draw Entities by Point Number* which allows the user to input point number ranges and plot Lines, Arcs, Polylines or 3D polylines. Coordinate files have either numeric or alphanumeric point numbers. Alphanumeric point numbers consist of nine or less digits and letters (i.e. point number 7A). The type of point number format is displayed at the top title bar of the main dialog.



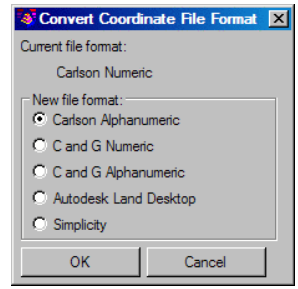
Open CRD File: Allows the user to switch to another file. When you exit Coordinate File Utilities this will be the current file that you work with in Carlson.

Copy/Merge CRD File: This command allows for the copying of entire CRD files, or parts of CRD files, to a new or existing files. This can be used to make a backup of your coordinate file, and it can also be very valuable in coordinate file manipulation. For example, if a certain range of points from one CRD file was also required in the active CRD file, this command would be used to simply copy the required range into the active CRD file. There are two options when first executing the command. These options are whether to import points from another file to the current (active) CRD file, or to export the current (active) coordinate file to another file.



Once this option has been decided, a prompt for the file to copy From or TO, will be displayed. Here simply specify the correct file. Next a prompt for the Point Number to Copy will be displayed. Here specify the points to copy. Point numbers and ranges can be entered together, for example, 1-3,10,15 would result in points 1 through 3and points 10 and 15 being copied. The next prompt is whether to renumber the points. If you choose Yes, which should be the choice if points with the same number already exist in the file you are copying to, you will be prompted for a number to begin renumbering. This number should be higher than any existing point number in the file. In addition you will be prompted to Compress the points if renumbering. This option removes points number gaps and renumbers the points sequentially beginning at the first number selected. If the point number order and value contain number gaps and it is crucial to keep this order DO NOT compress the points when promoted.

Convert CRD File Format: This allows you to convert the current CRD file from numeric format to alphanumeric format or visa versa. This routine will also change crd files to and from different software formats. These formats include C&G, AutoDesk Land Desktop, and Simplicity. The current format of the active coordinate file will be displayed as well as the options for the new file format. This command only changes the format of the active coordinate file.

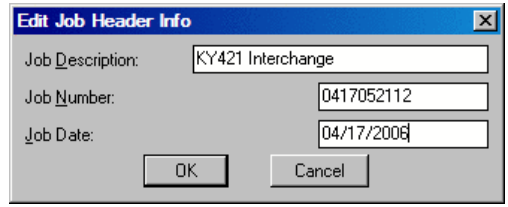


Map Points from 2nd File: This routine adds point to the current CRD file from points stored in a second CRD file. The points to copy are specified by numbers one at a time. Prompts for the destination point number (number to create in current crd file) and source point number (point number to be copied from second crd file) will be displayed.

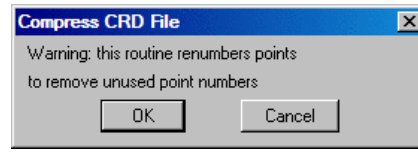
Import Text/ASCII File: This routine converts point data from a text file into the current coordinate (.CRD) file. See the *Import Text/ASCII File* command in this chapter for more information.

Export Text/ASCII Text File: This routine outputs point data from the current coordinate (.CRD) file to a ASCII Text file. See the *Export Text/ASCII File* command in this chapter for more information.

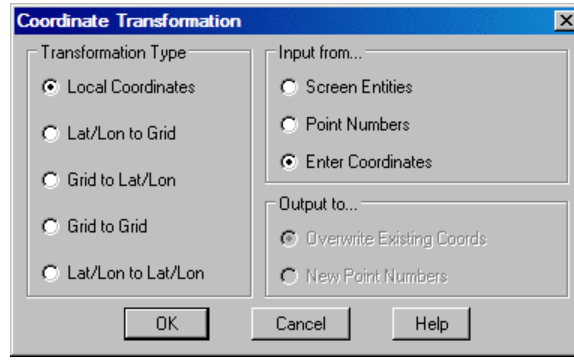
Edit Header: Enter or edit the job information associated with the coordinate file. The fields include Job Description, Job Number and Job Date. This information will appear on the List Point report. Non-digit characters are not allowed in the Job Number field.



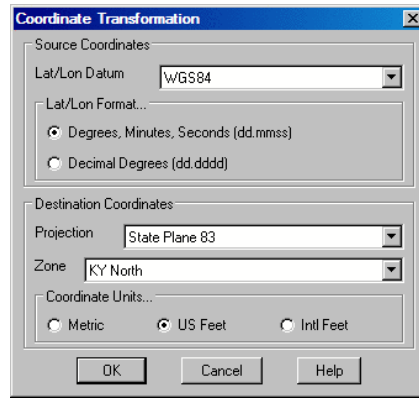
Compress CRD File: Removes unused point numbers by renumbering high point numbers into the unused spaces. For example, for an original file with points 1,2,105,107,108,109 would be compressed to 1,2,3,4,5,6.



Coordinate Transformation: Transforms coordinates between local, state plane 27, state plane 83, latitude/longitude, and Universal Transverse Mercator (UTM). Works on individually entered coordinates, by range of point numbers and with on-screen entities. For converting between state plane 27 and 83, Carlson calls upon NADCON from the National Geodetic Survey to apply the latitude/longitude adjustment. The NADCON program, ndcon210.exe, is stored in the Carlson EXEC directory.

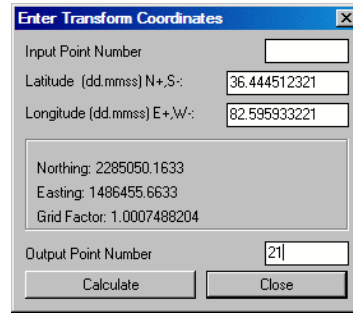


The Transformation Type is used to define the Source Coordinate and Destination Coordinate formats. Settings for Lat/Long Datum, Lat/Long formats (dd.mmss or dd.dddd), Projections, State Plane Zones and coordinate units are defined in the Transformation Type dialog. The format of this dialog will change depending upon the type of transformation requested.



Example Lat/Long to Grid dialog

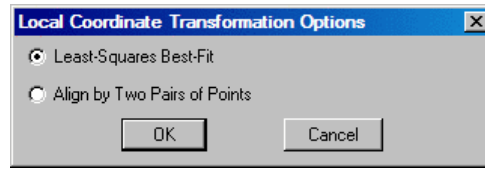
For all Transformation types, there are three options for inputting the data to be transformed. Data can be selected from the screen by using the **Screen Entities**. If a range of points or a particular point is desired, the **Point Numbers** option would be used. Manual entry of coordinates to transform one at a time is accomplished with the **Enter Coordinates** option. The coordinates can be typed in or use the Input Point Number option. Output Point Number is an option to store the results in the coordinate file.



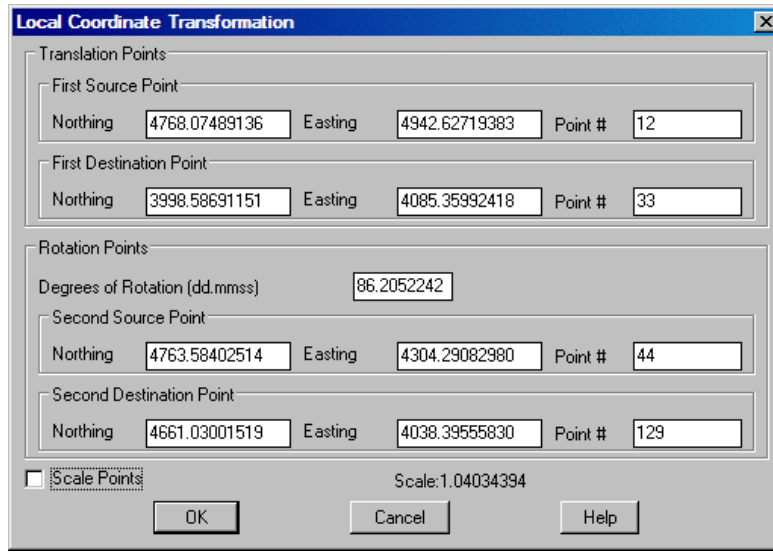
For all transformations there are two output options when using point numbers as the input data. **Overwrite Existing Coords** replaces the original coordinate values with the new coordinate values after transformation. **New Point Numbers** will retain the original coordinate data and point numbers and create new point numbers with the revised coordinate data after transformation.

When transforming a **Local Coordinate System**, there are two options for defining the transfor-

mation as shown in the next dialog.

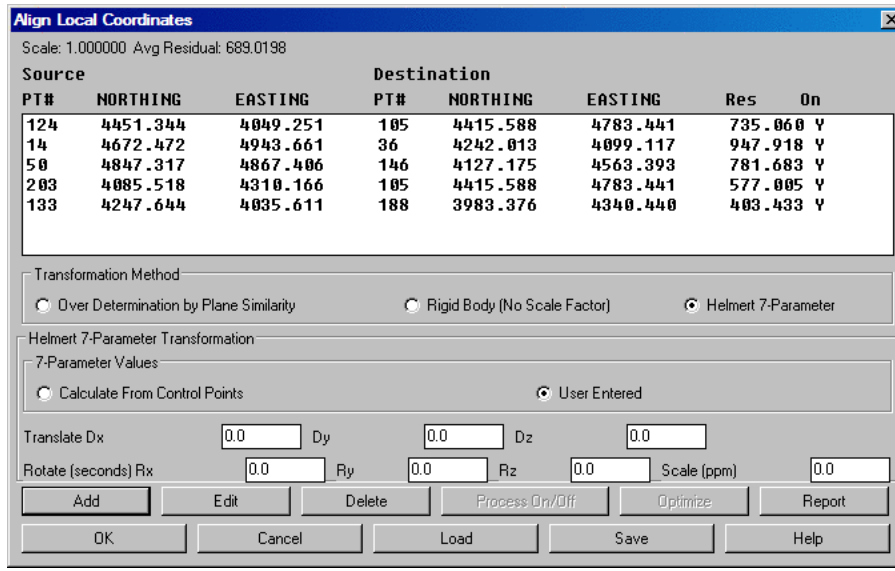


The **Align by Two Pairs of Points** option uses two pairs of source and destination coordinates. The first pair defines the translation as the difference between the source and destination northing and easting.



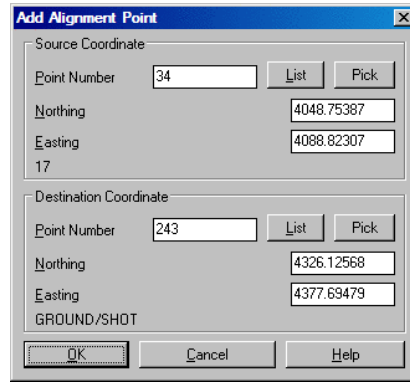
This destination point is also the pivot point for rotation. Rotation can be entered directly or defined by a second pair of points where the bearing between the first and second source points is rotated to align with the bearing from the first and second destination points. There is an option to also apply scaling. The scaling holds the angle between points and adjusts the distances by the scale factor. The scale factor is calculated for each point as the elevation factor at the first source point times the grid factor at the first destination point averaged with the elevation factor at the transform point times the grid factor at the transform point.

The **Least-Squares Best-Fit** option is used when there are more than two pairs for translation points. Since two pairs of points are sufficient to define the translation and rotation, more than two pairs of points provides more than enough information.



Over **Determination by Plane Similarity** is used to find the least squares best fit transformation for all the given source and destination points. Besides doing a translation and rotation, this option will also scales the points during the transformation. **The Rigid Body Transformation** also does a best fit least squares transformation, but applies only translation and rotation with no scale. The **Helmert 7-Parameter** method can also be used for local transformations. The **7-Parameter Values** can be calculated from control points or entered by the user.

The **Add** button is used to define the source and destination coordinates for the points that define the transformation. Pressing this button brings up the following dialog box.



The **Edit** button is used to edit existing data.

The **Delete** button removes the source and destination pairing from the transformation setup.

The **Process On/Off** button allows source and destination pairings to be turned on and off. This is useful when wanting to inspect different results using different pairings.

The **Optimize** option chooses which point pairings would yield the best transformation results by turning off the processing of pairings with higher residuals. This minimizes the average residual for the control points.

The **Report** option displays a report of the transformation point pairings, their residuals, processing status, transformation scale and avg. residual.

The **Load** and **Save** options allow for saving and recalling local coordinate transformation pairings and settings.

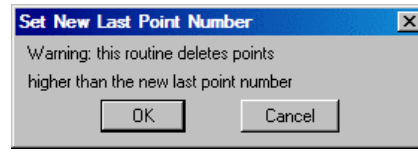
Draw Entities by Point ID: Draw Lines, Arcs, 3DLines, Polylines or 3DPolys by defining a range of point numbers.

Prompts

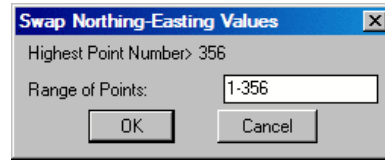
Plot Entities by Point Number
Type of entity, Arc/Polyline/3dpoly/2dline/Exit/<Line>: *P* This response causes the program

to plot polylines.
Example: '1∗4-7-10∗12-5-8' would draw lines from point number's 1 through 4 then to 7, to 10 through 12, then to 5 to 8. (limit 132 characters)
Undo/<Enter point numbers or ranges>: *1∗10-20∗30*
The program draws a polyline from point number 1 through 10 to point number 20 through 30.

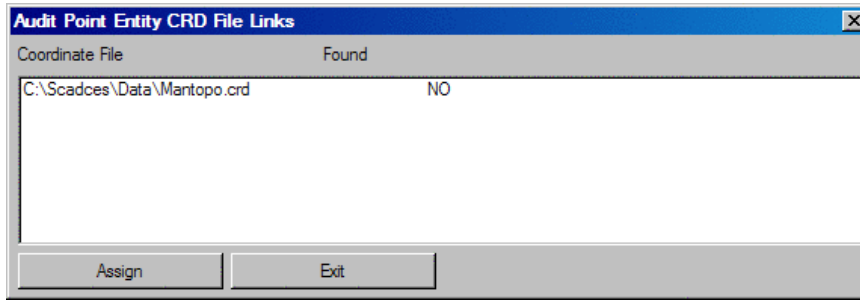
New Last Point Number: This option sets the highest point number in the CRD file. All points above this number are erased.



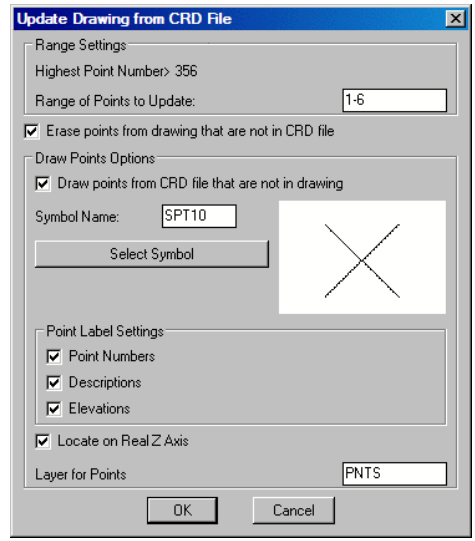
Swap Northing-Easting: This option allows you to swap northing and easting coordinates for any selected range of points. What was the northing of an existing coordinate point, or range of points, becomes the easting. And the easting(s) becomes the northing(s).



Audit Point Entry CRD File Links: This option lays out the audit point entity CRD file links in an ordered list for review.



Update Drawing from CRD File: This function updates the position of Carlson points in the drawing to match the position stored in the coordinate file. This command also has options to erase and draw points. For the erase option, points are erased from the drawing if the point number does not exist in the coordinate file. For the draw option, if a point number in the CRD file does not exist in the drawing, then this point is drawn using the settings from the dialog. The number of points modified, erased and drawn is reported at the end of the command.



Update CRD File from Drawing: This function allows you to select all or some of the points in the drawing and add or update them to the .CRD file. The points can be filtered with AutoCAD's Select Objects: selection mechanism and/or wild card matching of the point descriptions. The Update Point Descriptions option determines whether the point descriptions from the drawing will be stored to the CRD file. Use this command to update the file after a global edit such as *Move, Rotate, Renumber Points, Change Elevations, Erase,* etc. This routine directly reads Leica (Wildsoft), Softdesk, Geodimeter, InRoads, Land Development Desktop, and Eagle Point point blocks.

List Points: List the points stored in the .CRD file. See the *List Points* command in this chapter for more information.

Delete Points: Deletes points in the coordinate (crd) file by point number or description.

Screen Pick Point: Pick a point on the graphics screen and it's coordinate values are added to the coordinate (crd) file. Prompts for point number, elevation and description will be displayed. This command does not plot a point, point attributes or point symbol. Use the command *Draw-Locate Points* command to do this.

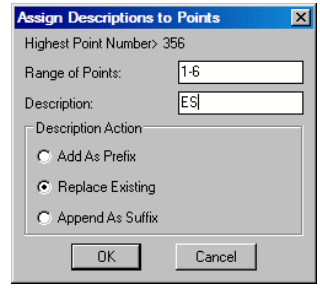
Scale Points: This option multiplies the point northing, easting, and elevation by the scale conversion factor. You can use this routine for metric-English conversion. See the *Scale Points* command in this chapter for more information.

Translate Points: This option translates a range of points based on entered delta x and delta y, entered coordinates or translation point numbers. See the *Translate Points* command in this chapter for more information.

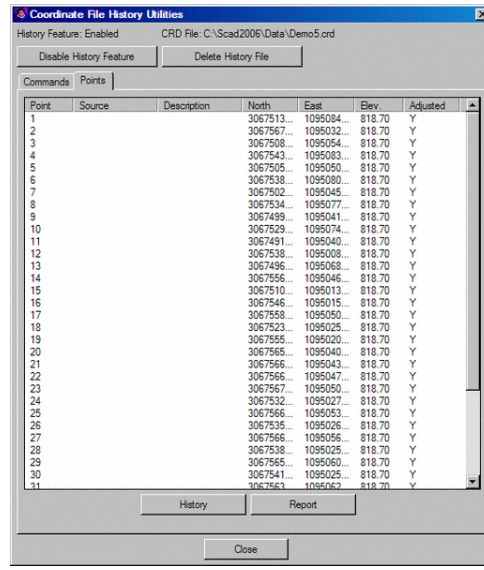
Rotate Points: This option rotates a range of points based on entered degrees or rotation, entered azimuths, entered bearings or rotation point numbers. See the *Rotate Points* command in this chapter for more information.

Align Points: This option does a translate based on a source point and destination point and then rotates to align the first source point and a second source point with the first destination point and a second destination point. See the *Align Points* command in this chapter for more information.

Description for Points: This option sets the point description field with the user-specified text for a range of point numbers.

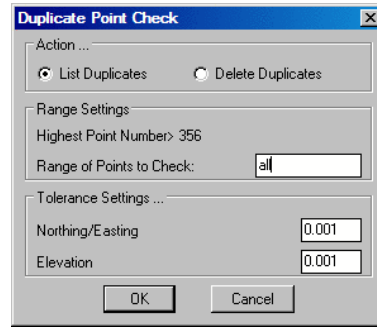


Elevation for Points: This option sets the elevation of a specified point or range of points.



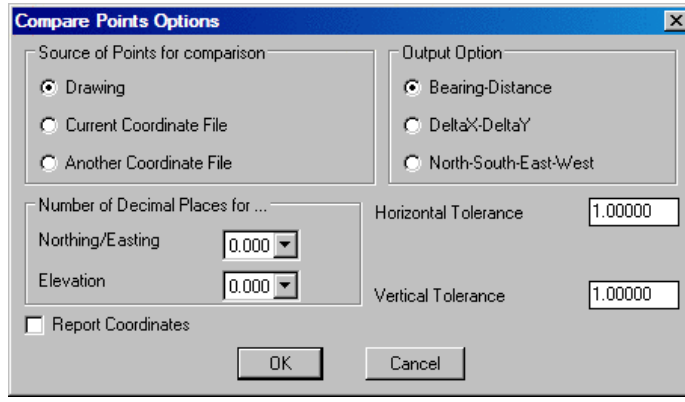
Point Number Report: This routine lists the used and the unused point numbers in the CRD file.

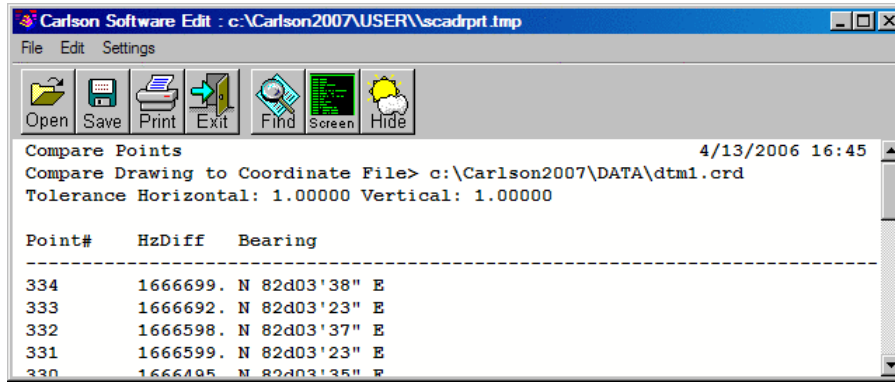
Duplicate Points: This function searches the CRD file for points with the same northing, easting and elevation. The tolerances for considering points to have the same coordinate are set in the dialog separately for northing/easting and elevation. To be counted the same coordinate, both the northing/easting and elevation must be within the tolerance distance. The duplicate points can be erased or only reported. For the erase option, the first point number is kept and any higher point numbers with duplicate coordinates are erased from the CRD file.



Compare Points: This function compares the coordinates in the .CRD file with either the coor-

dinates for the matching point numbers in the drawing file, with matching point numbers from another CRD file or with different point numbers from the same CRD file. A report is created for any differences that shows the point numbers and the differences. The difference can be reported as a bearing and distance between the two points, as distance North/South and East/West or as the delta-X and delta-Y. There is an option whether to include the point coordinates in the report.

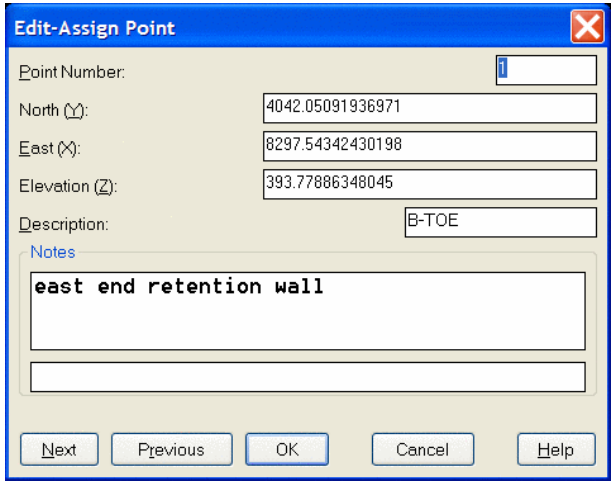



Carlson Software Edit : c:\Carlson2007\USER\\scadrprt.tmp
File Edit Settings
Open Save Print Exit Find Screen Hide
Compare Points 4/13/2006 16:45
Compare Drawing to Coordinate File> c:\Carlson2007\DATA\dtm1.crd
Tolerance Horizontal: 1.00000 Vertical: 1.00000
Point# HzDiff Bearing
334 1666699. N 82d03'38" E
333 1666692. N 82d03'23" E
332 1666598. N 82d03'37" E
331 1666599. N 82d03'23" E

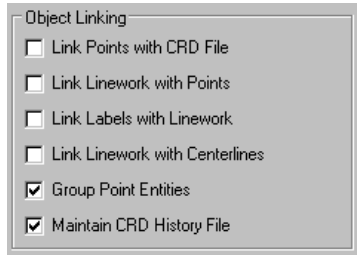
Example Bearing-Distance format Compare Points Report

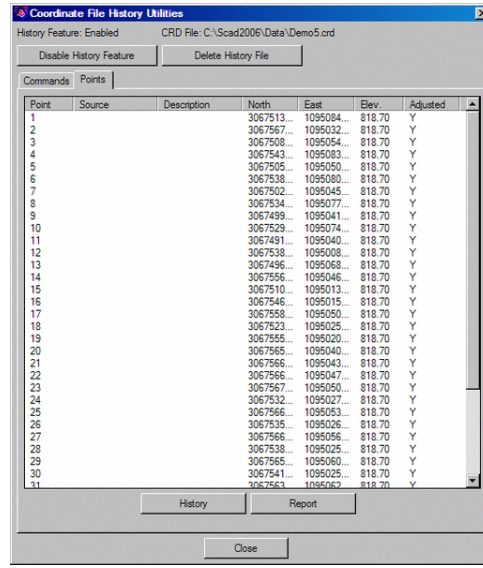
Renumber Points: This option renumbers points in the user-specified range starting from a new point number. The old point numbers are erased. The condense points will renumber such that there are no unused point numbers in the renumbered range. Otherwise the spaces between the points is maintained. In the example shown, renumbering 1-25 with points 1,2,24,25 to starting point number 101 will result in points 101,102,103,104 if condense is on or 101,102,124,125 if condense is off.

Input-Edit Point: Enter or edit the coordinate values or the description of a point. The Notes section is for adding optional point notes which are additional point descriptions. The standard description field is limited to 32 characters. Under notes, any number of lines of text can be assigned to the point. A list box shows the lines of notes. To add a note line, pick a blank line in the list box and then type in the note in the edit box belong the list box and press Enter. To edit a note, highlight the line in the list box and edit the text in the edit box.



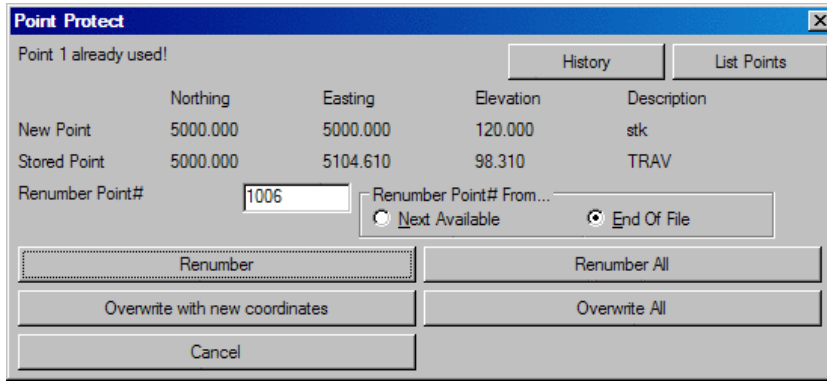
Point History: All changes to the coordinate file will record the commands performed on this coordinate file and the status of the points themselves. This makes up the coordinate file history. The history can then be reported by point number or by command. All of the changes can be rolled back. It is important to note that if maintaining such a history file is your objective, in the Settings > Configure > General Settings dialog you must make sure that Maintain CRD History File is checked.





The **Disable History Feature** button at the top of the dialog shown above is a toggle device. It should be clicked if you prefer not to build the point history file. Clicking it a second time changes it back to saying **Enable History Feature**. You can also choose **Delete History File** to delete the file altogether. By clicking any point from the list, as shown in the Points tab example above, and then selecting **History**, you will be given the history for that specific point. Double-clicking on any command shows the details. Clicking on **Details** also shows the selected command's details. **Undo thru Selected** will undo the effect of all of the commands up through and including the selected command. The changes from the undo command are themselves then added to the command list and can be undone in the future.

Point Protect Toggle: This option, located at the bottom-left of the main *Coordinate File Utilities* dialog, toggles point protection on and off. With this option on, when attempting to store a point with a point identifier (point number) that already exists in the current coordinate file, the following dialog will be displayed.



Overwrite with new coordinates will update the existing point number with the new location of the point.

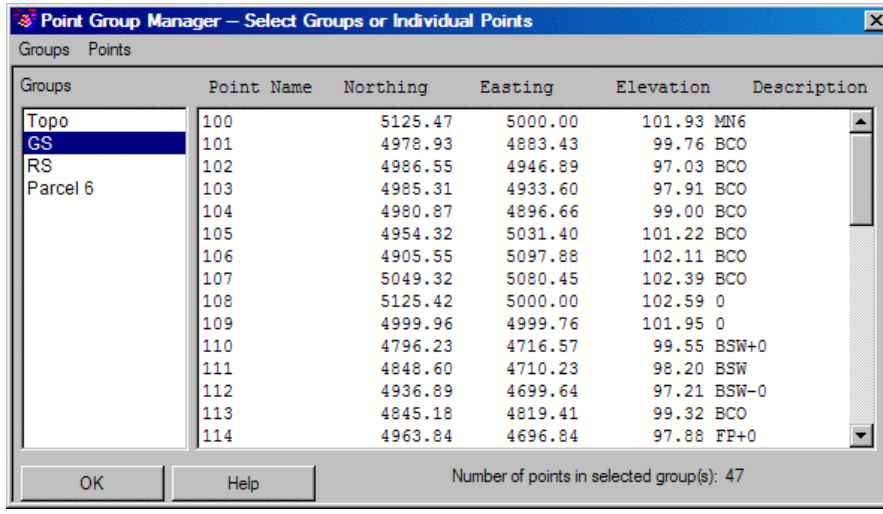
The **Use Another Number** field displays the point number that will be used if the Use Another Number option is selected. This number will depend upon the option chosen from the **Another Number From** settings. If **Next Available** is chosen, the next available number will be displayed in the Use Another Number Field. If there are number gaps in the coordinate file this number will not be the next highest number in the file. For example if points 1-10 and 20-30 exist in the crd file leaving a gap from 11-19, the Next Available number would be 11. If the desired point number, in this example, is 31, then the option of **End of File** would be selected.

The **Overwrite All** and **Renumber All** options apply when more than one point with the same number exists in the coordinate file. These options are helpful when importing points into existing CRD files.

Pulldown Menu Location: Points
Keyboard Command: cfu
Prerequisite: None
File Names: \lsp\crdutil.lsp, \lsp\crdutil.arx, \lsp\scadcfu.dcl, \lsp\scadfile.dcl

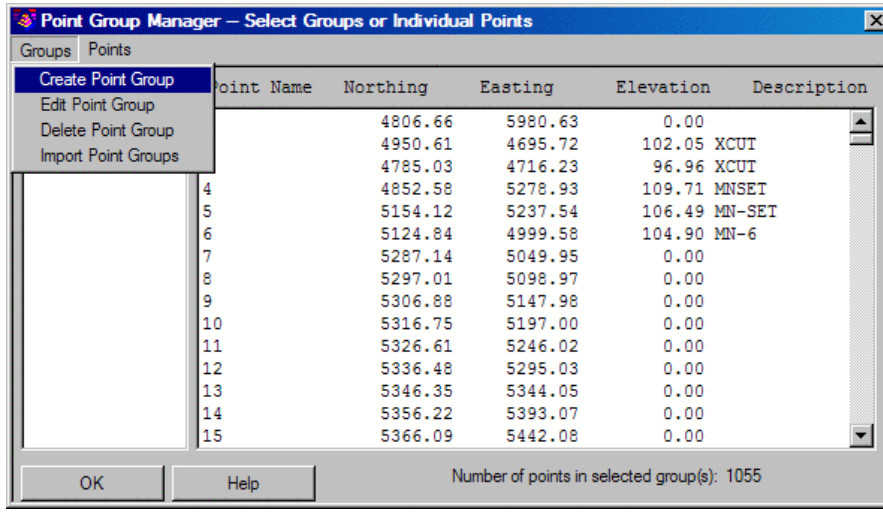
Point Group Manager

This command is used to create point groups based on inclusion and exclusion filters. The manager can perform various functions on these point groups. Also point groups can be referenced by group name in other commands such as Field to Finish and Data Collection.



Groups Pulldown

Create Point Group: This option creates point groups. When selected, the New Point Group dialog box is displayed.



Group Name is the name of Point Group to create.

Description is the description of Point Group to create.

Use the **Include Tab** to define the filters to be applied when creating the point group. Inclusion rules are applied before the exclusion rules.

When **Include All** is toggled on, all points in the coordinate file will be included in the selection.

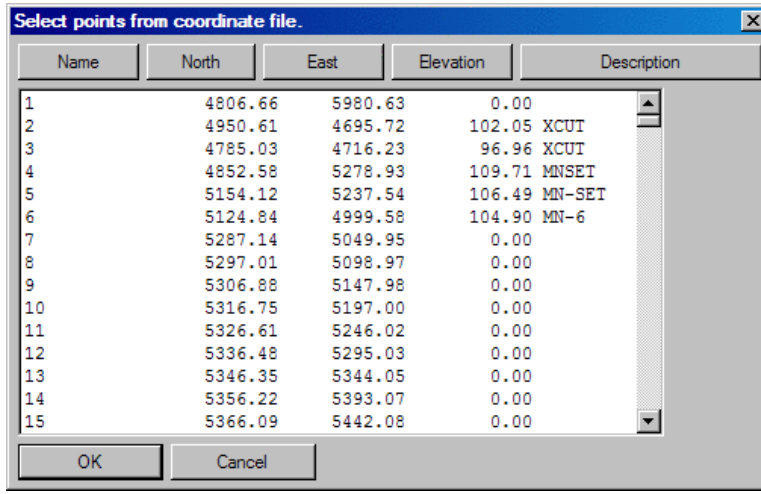
When **Point List** is toggled on, an option of defining the point list must be selected.

DWG: Select allows for manual selection of the points to include from the drawing. The points must be drawn on the screen prior to using this option. All standard AutoCAD selection tools, are available for selection of the points.

DWG: Add Within Circle allows for selection of the points to include by a user defined circle. The circle is defined by specifying the center and radius of the circle. The radius can be defined by entering in a numeric value or by picking on the screen. Points must be drawn to the screen prior to using this option.

DWG: Add Within Polyline allows for the selection of points to include by referencing a closed polyline. All points located within the closed polyline will be included in the selection. Prompts for the inclusion polyline and the exclusion polyline will display. The inclusion polyline limits of the selection area. The exclusion polyline defines the area to exclude within the inclusion polyline. Points must be drawn to the screen prior to using this option.

CRD: Select allows for manual selection of the points to include from a point list. Standard window selection tools are available for selecting the points to include.



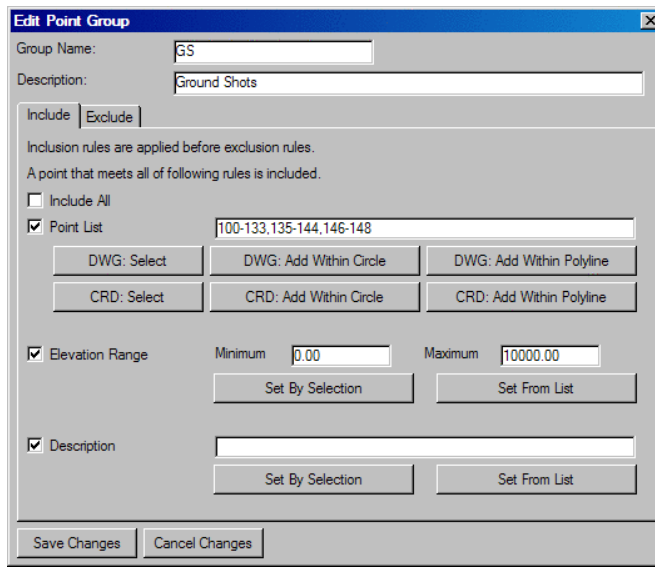
CRD: Add Within Circle allows for selection of the points to include by a user defined circle. The circle is defined by specifying the center and radius of the circle. The radius can be defined by entering in a numeric value or by picking on the screen. The points do NOT have to be drawn to the screen prior to selection.

CRD: Add Within Polyline allows for the selection of points to include by referencing a closed polyline. All points located within the closed polyline will be included in the selection. Prompts for the inclusion polyline and the exclusion polyline will display. The inclusion polyline limits of the selection area. The exclusion polyline defines the area to exclude within the inclusion polyline. The points do NOT have to be drawn to the screen prior to selection.

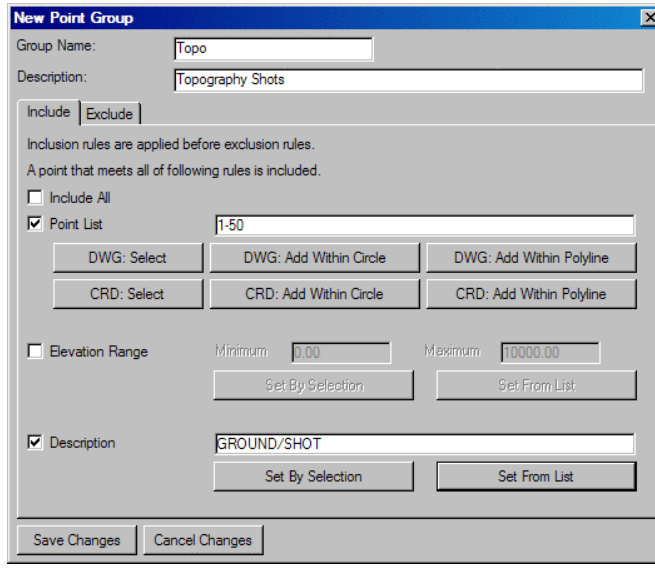
Elevation Range allows for the selection of points within a specified elevation range to be included in the group. The minimum and maximum elevations can be entered manually in their respective data fields. The minimum and maximum values can also be specified by the Set By Selection and Set From List options.

Set By Selection allows for selection of points to include in the group from the drawing. The points must be drawn to the screen prior to using this selection method. Standard AutoCAD selection methods are available.

Set From List allows for selection of points to include in the group from a point list. Standard Windows selection tools are available with this option.



The **Description** option allows for a selection of points to include based upon the description of the point. The description to filter for can be entered in the data field or by using the Set By Selection and/or the Set From List options described above.

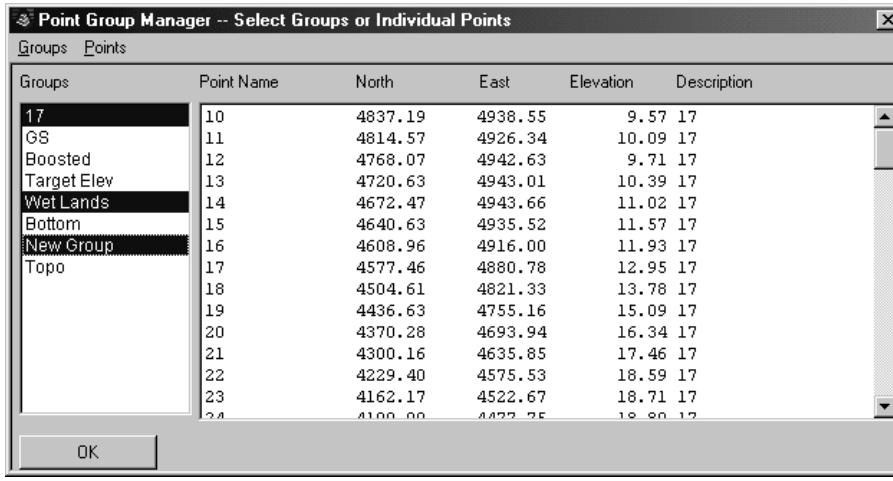


The **Exclude Tab** allows for defining rules that pertain to the points to be excluded from the Inclusion selection. After defining the inclusion rules for the group, the options on the Exclude tab can be used to filter for points to exclude from the group. For example, if the inclusion rules call for all points within the elevation range of 8 to 12, an exclusion rule can be set to exclude the points on elevation 9 or with the description tree. The options on this tab work exactly like the options on the Include tab. Please refer to the Include tab definitions for further instruction.

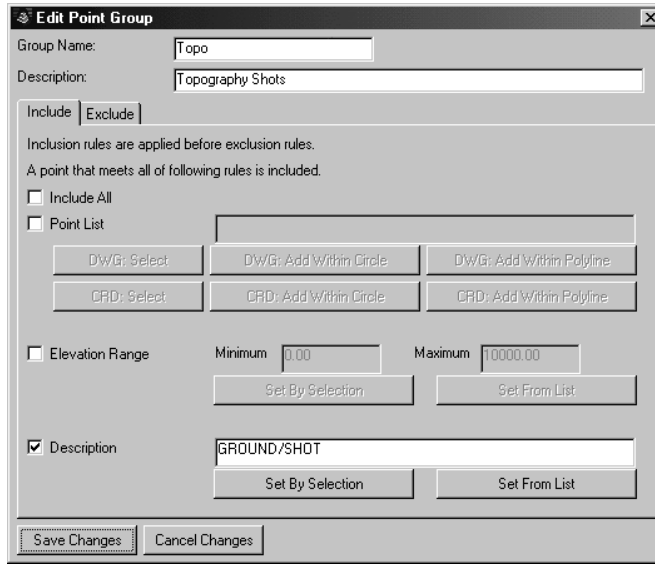
Save Changes saves the point group to the group name specified based upon the Inclusion and Exclusion rules specified.

Cancel Changes discards specified rules and changes and goes back to the Point Group Manager dialog.

Edit Point Group allows for editing of existing point groups. From the list of available groups, highlight the group or groups to edit. When complete with the first group, if more than one is selected, selecting the Save Changes option will save the changes to the active group and switch to the next group in the selection set.



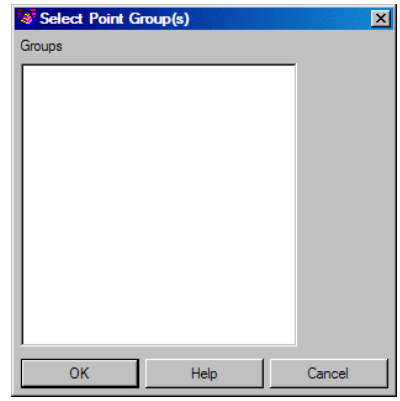
From the Groups pulldown, select Edit Groups, the Edit Group dialog box will now appear.



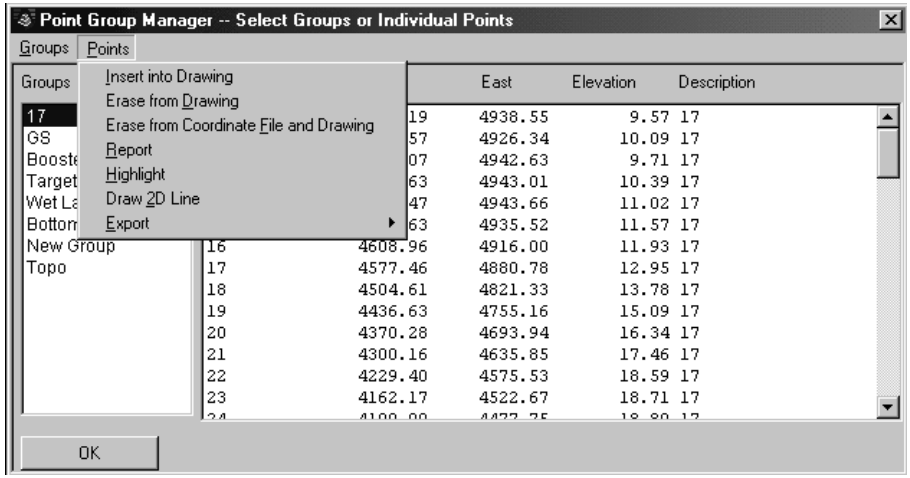
See Create Point Groups for further definitions of the available options.

Delete Point Groups deletes specified groups for the existing group list. One or more groups can be deleted at one time.

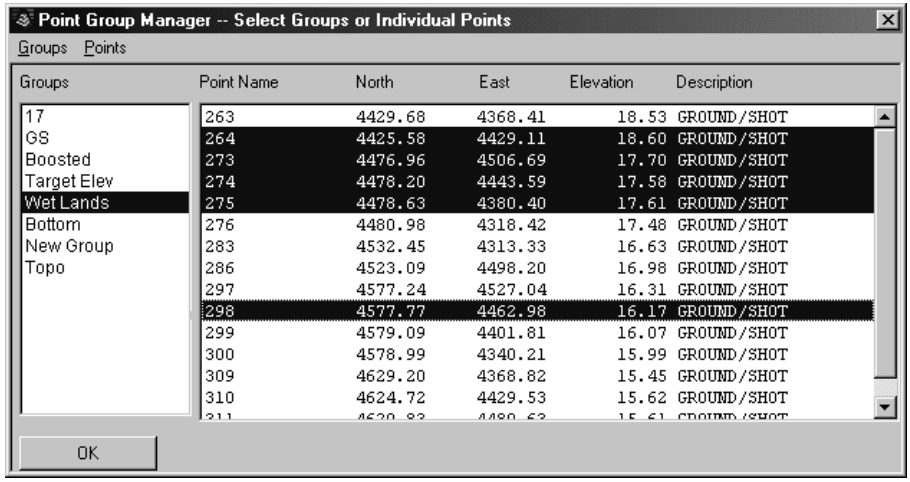
Import Point Groups allows for importing filters from point group manager settings of other coordinate files. This is a useful option when coordinate files are going to contain same point group names with the same filters. This option only brings in the filters into the point group manager, it does not import actual points into the coordinate file by group name. Existing points in the active coordinate file that meet the filter definitions of the imported point groups will automatically be added to the corresponding group.



Points Pulldown



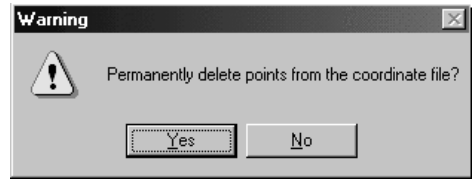
The **Insert into Drawing** option draws the points in the group in the drawing. Individual points or point ranges can be selected from the group to be erased from the drawing. For example points 264-275 and point 298 contained in group Wet Lands are tagged to be erased from the drawing in the following figure.



The symbol to be used and the attribute layout are determined by the Point Default Settings. The symbol size and the point attribute size are determined by the settings in the Drawing Setup routine.

Erase from Drawing erases specified point group/groups or specified points from within the group from the drawing.

Erase from Coordinate File and Drawing erases the points in the specified group/groups or specified points from within the group from the drawing and will also permanently delete the points from the CRD file. You will be prompted with a warning as follows:



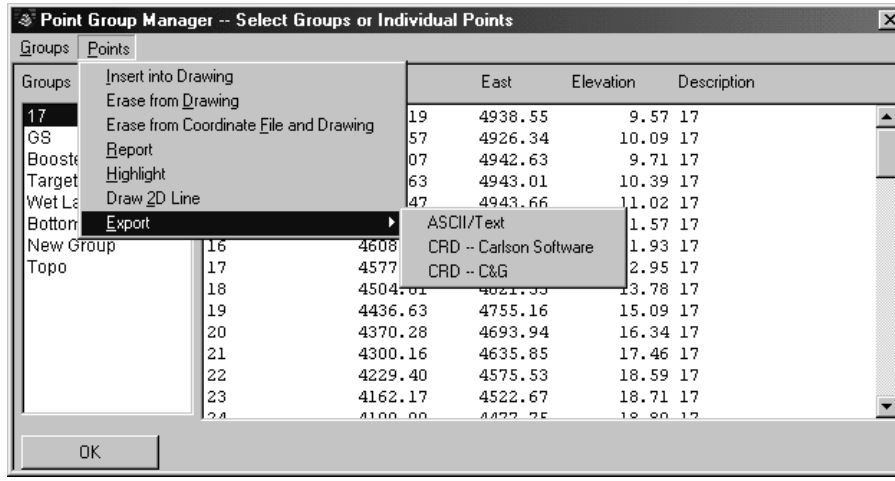
Selecting **Yes** will complete the command and erase the points from the screen and also the coordinate file. Selecting **No** will cancel the command leaving the drawing and the coordinate file unchanged.

The **Report** option will generate a point list of the points contained in the selected group/groups or specified points from within the group.

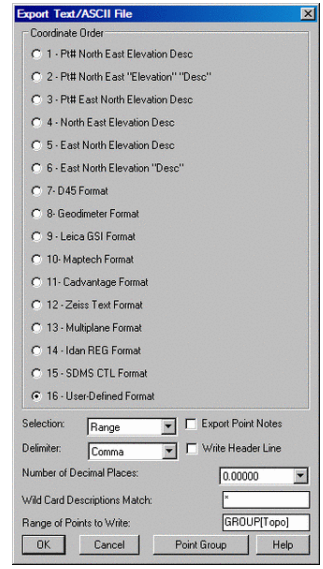
The **Highlight** option highlights the specified objects in the drawing. This makes them distinguishable from the other points on the screen.

The **Draw 2D Line** option draws a 2d polyline between the points contained in the group/groups or between specified points in a group.

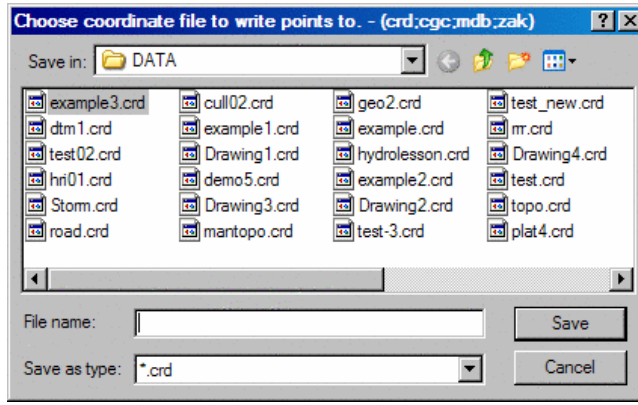
The **Export** command exports the selected group/groups or the specified point(s) or range of points from within the group to various formats. The available formats are ASCII/Text, Carlson Software CRD and C&G CRD files.



When **ASCII/Text** is selected, the Export Text/ASCII File dialog box will be displayed. Please refer to the Export Text/ASCII File section of the manual for more information.



The **CRD-Carlson software** command writes the selected group/groups or the specified point(s) or range of points within the group to a new Carlson formatted CRD file.



Specify the file name of the CRD file to create and press save.

CRD-C&G writes the selected group/groups or the specified point(s) or range of points within the group to a new C&G formatted CRD file.

Specify the file name of the CRD file to create and press save.

Pulldown Menu Location: Points
Keyboard Commands: pgm
Prerequisite: A coordinate file
File Names: \lsp\crdutil.arx

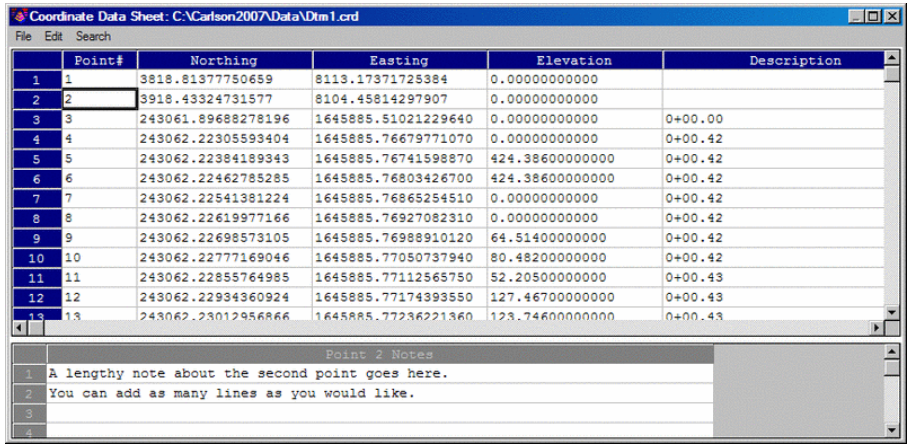
Edit Points

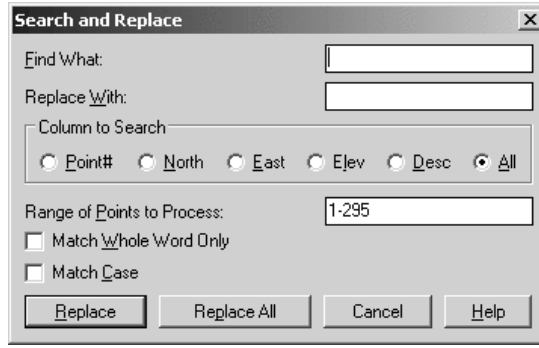
Function

This command edits point data in the current coordinate file or within a point range. The current coordinate file can be set with the Set Coordinate File command. Edit Points shows all the points in the coordinate file. New points can be added and points can be deleted by using the Insert and Delete keys.

This tool also lets you edit notes associated with each point. While the standard point description is limited to 32 characters, the drawing notes are not. When you click on a given point, you can add numerous lines of notes about that point in the bottom of the dialog. Keep in mind that these notes are stored in a separate file with the extension ".not" having the same name as the CRD and

residing in the same folder.





Pulldown Menu Location: Points
Keyboard Command: editpt
Prerequisite: None
File Name: \lsp\rawedit.arx

Erase Points

Function

This command erases Carlson points inserts from the drawing. The points to erase can either be selected from the screen or specified by point number, point number range or by point group. Erasing a Carlson point will erase the point symbol, point attributes, and point node. The points may optionally be erased from the coordinate file. As long as the points are not deleted from the coordinate file, they can be redrawn with *Draw-Locate Points.*

Prompts

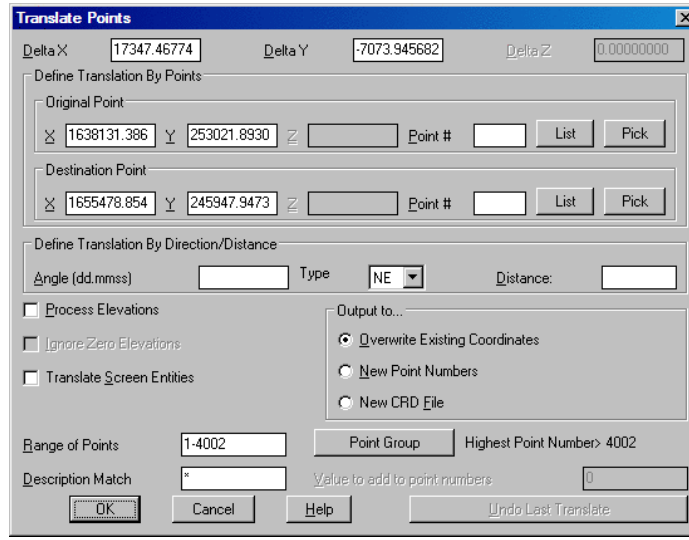
Select points from screen, group or by point number [Screen/Group/<Number>]? *press Enter*
Point numbers to erase: *1-5*
Delete points from coordinate file (Yes/<No>)? *press Enter*
Erasing Carlson Points ....
Number of points erased> 5

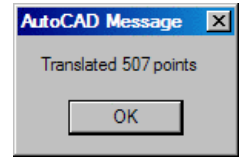
Pulldown Menu Location: Points
Keyboard Command: DELPT
Prerequisite: Carlson points to be erased
File Name: \lsp\delpt.lsp

Translate Points

Function

This command translates points in a coordinate file from one coordinate position to another. The delta X, Y, and Z can be entered directly or calculated from original and destination coordinates. The original and destination coordinates can be entered directly, specified by point number, selecting the point number from a point list by selecting the list icon, or selected from the screen by selecting the pick icon. Once these points have been specified, the Delta X,Y,Z, if Process Elevations is checked ON, fields will be filled in with their calculated values. Any points in the drawing will be updated automatically in addition to updating the coordinate file.





Define Translation By Angle/Distance requires a specified direction, Northeast (NE), Southeast (SE), Southwest (SW), Northwest (NW) or Azimuth (AZ) along with a specified distance in order to perform a translation. Once the direction and distance are entered, the Delta X,Y,Z will be calculated. This is a useful command when you know that the job needs to shift, for example, to the Northeast 25 degrees for a distance of 100 feet. Here you would simply type in 25 in the Angle (dd.mmss) field, choose NE in the Type field and then enter the distance of 100 in the Distance field.

With **Process Elevations** checked, all elevations will be translated by the specified or calculated Delta Z value. This option is very useful in correcting point elevations after performing a survey with assumed elevations and then later surveying into a benchmark with known true elevation. In this case only the Delta Z value, use (-) to indicate a lower correction, and the range of points to translate would be required for a translation. For example if the entire job needed to be lowered by 5', the Delta Z would be defined as -5 and the Range of Points defined as ALL.

Ignore Zero Elevations is only available when Process Elevations has been chosen. With this

option checked ON, all points with an elevation of 0 will be ignored resulting in no translation taking place on these points.

With **Translate Screen Entities** checked ON, after specifying the point range or group to translate and selecting OK on the dialog box the following command line prompt is displayed:
Select objects to rotate (points excluded):
At this prompt select the objects on the screen, polylines, lines, arc, etc., to also translate and press enter. The translation of the points and screen entities will be completed.

Various **Output Options** for the translated points are available.

Overwrite Existing Coordinates will overwrite the existing coordinate points with the new translation coordinates thus changing the coordinate values in the existing crd file.

New Point Numbers will assign new point numbers to the translated coordinate points and leave the original coordinate points unchanged and present in the coordinate file. When using this option, on the Range of Points to Translate dialog, there is a Value to add to point numbers field. In this field, enter the value to add to the point numbers. For example if the existing point numbers are 1-20, and the value to add is 100, the resulting new point numbers will begin at 101 and end at 120.

New CRD File will place the translated coordinates in a new crd file. After selecting OK to the range of points to translate dialog, the Coordinate File to Create dialog will appear. On this dialog enter the name of the new crd file and select save. The original crd file will remain unchanged and the new file will contain the points with the translated coordinates.

Specifying the points to be translated is accomplished either by specifying a **Range of Points** (1-20,33,36-40....) or by **Point Groups**. If using the Point Group option, the Select Point Group(s) dialog box will be displayed allowing for the selection of the Group(s) to rotate.

The **Description Match** option only translates points with the description(s) specified in this field.

Undo Last Translation restores the points to their previous location before translation. It is important to note that if Translate Screen Entities has been checked to restore the translated objects to their previous location will require the use of the undo command located in the Edit pulldown.

The AutoCAD command *MOVE* can be used to translate points on the screen but this does not update the coordinate file unless you have the option Link Points with CRD File turned ON in *Configure* . (Note: This toggle must have been turned ON prior to locating the points). If you do

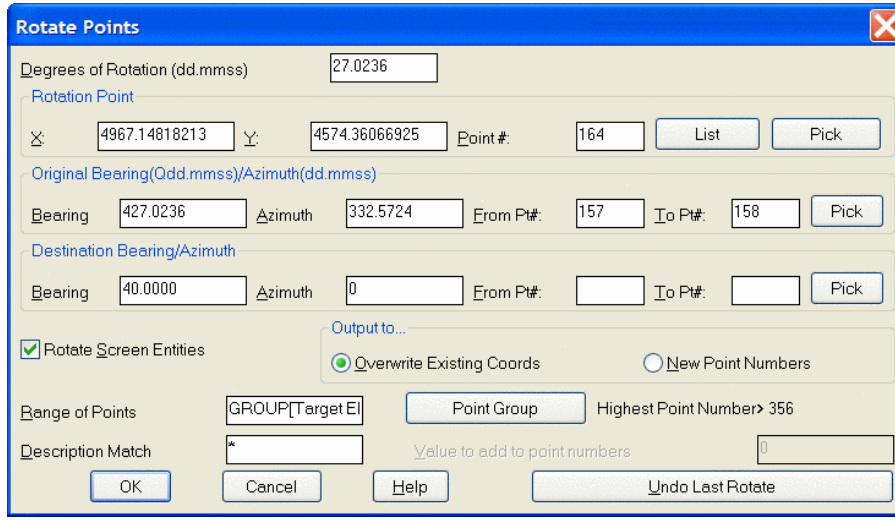
use the *MOVE* command and the CRD file needs updating, run the command *Update CRD file From Drawing* found in *Coordinate File Utilities.*

Pulldown Menu Location: Points
Keyboard Command: transpt
Prerequisite: points in a coordinate file
File Name: \lsp\crdutil.arx

Rotate Points

Function

This command rotates points in a coordinate file. The degrees of rotation can be entered directly or calculated from original and destination bearings or azimuths.



The **Rotation Point**will remain unchanged while the points specified for rotation rotate around it. This point can be specified by using the **List** button to pick from a list of points contained in the coordinate file, or from the screen by using the **Pick** button. The rotation point can also be defined by a coordinate value by manually entering in the X and Y values of the point. This point must be defined before the rotation will take place.

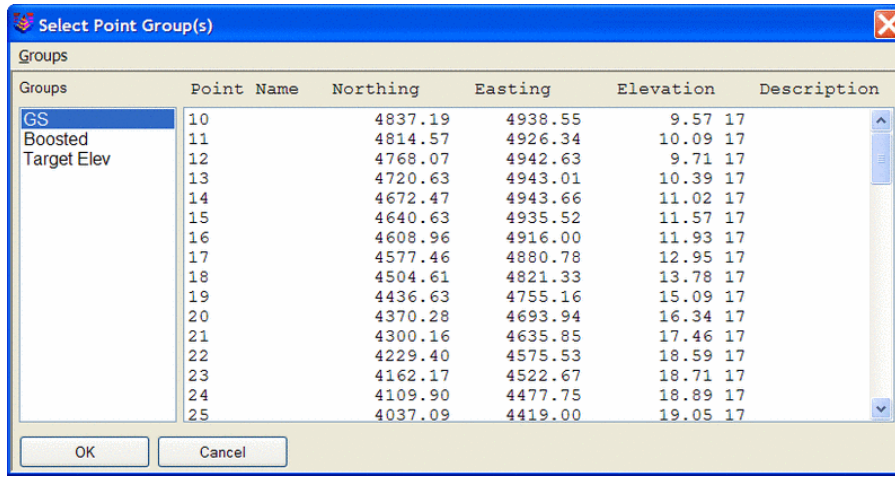
The **Original Bearings/Azimuths** and **Destination Bearings/Azimuths** can be entered directly or specified by point numbers. If using a pair of points to define the original bearing and then specifying the destination bearing by entering in the desired Bearing/Azimuth, the From and To Pt# fields should be left blank in the destination bearing/azimuth settings. Use the From and To Pt# fields in the Destination Bearing/Azimuth when you want to make a direction or Bearing/Azimuth between two existing points match the Bearing/Azimuth between two other existing points within the file. For example, to make the bearing between points 10-12 match the bearing between points 25-26, the Original Bearing/Azimuth could be defined as From Pt#10 To Pt#12 with the Destination Bearing/Azimuth defined as From Pt#25 To Pt#26.

With **Rotate Screen Entities** checked ON, after specifying the point range or group to rotate and selecting OK on the dialog box the following command line prompt is displayed:
Select objects to rotate (points excluded).:
At this prompt select the objects on the screen, polylines, lines, arc, etc., to also rotate and press enter. The rotation of the points and screen entities will be completed.

Various **Output** options for the rotated points are available.

Overwrite Existing Coordinates will overwrite the existing coordinate points with the new translation coordinates thus changing the coordinate values in the existing crd file.

New Point Numbers will assign new point numbers to the translated coordinate points and leave the original coordinate points unchanged and present in the coordinate file. When using this option, on the Range of Points to Translate dialog, there is a Value to add to point numbers field. In this field, enter the value to add to the point numbers. For example if the existing point numbers are 1-20, and the value to add is 100, the resulting new point numbers will begin at 101 and end at 120.



Specifying the points to be rotated is accomplished either by specifying a Range of Points (1-20,33,36-40....) or by Point Groups. If using the Point Group option, the Select Point Group(s) dialog box will be displayed allowing for the selection of the Group(s) to rotate.

The **Description Match** option only rotates points with the description(s) specified in this field.

The points that have been specified for rotation that are present in the drawing will be graphically updated to their new location in addition to an automatic update of the coordinate file.

Undo Last Rotate restores the points to their previous location before rotation. It is important to note that if Rotate Screen Entities has been checked to restore the rotated objects to their previous location will require the use of the undo command located in the Edit pulldown.

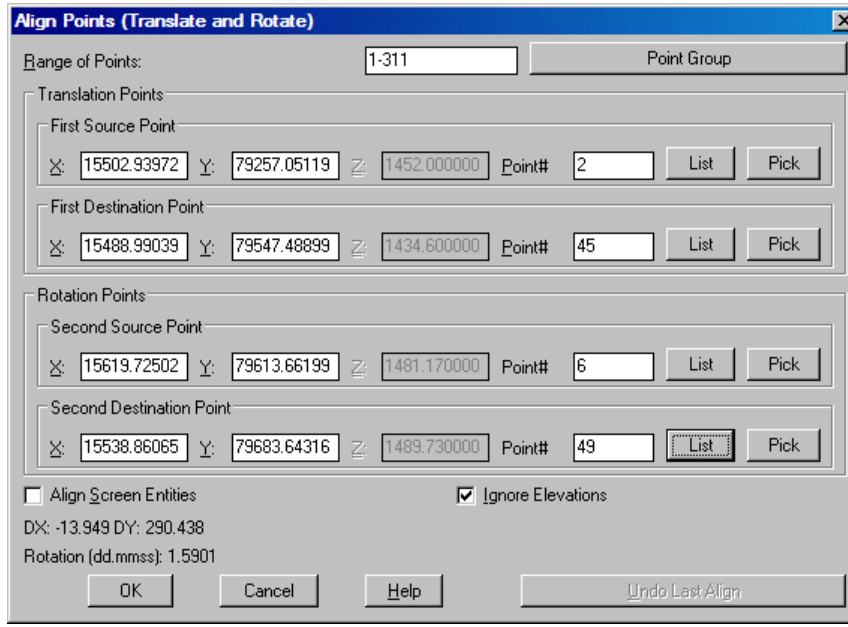
Pulldown Menu Location: Points
Keyboard Command: rotatept
Prerequisite: points in a coordinate file
File Name: \lsp\crdutil.arx

Align Points

Function

This command translates a specified Range of Points or Points Group(s) based on a source point

and destination point and then rotates to align the first source point and a second source point with the first destination point and a second destination point. The command basically combines the Translate and Rotate Point commands. To specify a Range of Points to align, enter the range to align or select a point group(s) by selecting the Point Group button. Each of the Translation and Rotation points, both Source and Destination points, can be entered manually or picked from the point list by selecting the List button.



When **Align Screen Entities** is checked, after specifying the point range or group to align and selecting OK on the dialog box the following command line prompt is displayed:
Select objects to rotate (points excluded): At this prompt select the objects on the screen, polylines, lines, arc etc., to also align and press Enter. The alignment of the points and screen entities will be completed.

When **Ignore Zero Elevations** is checked, all points with an elevation of 0 will be ignored in the alignment.

Undo Last Align restores the points to their previous location before alignment. It is important

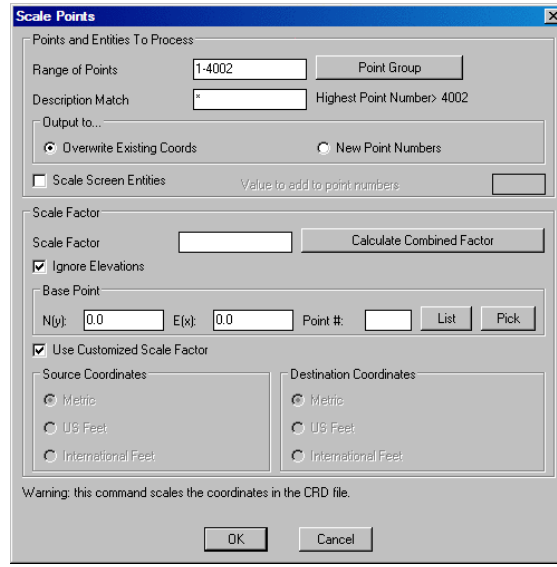
to note that if Align Screen Entities has been checked to restore the aligned objects to their previous location will require the use of the undo command located in the Edit pulldown.

Pulldown Menu Location: Points
Keyboard Command: alignpt
Prerequisite: Points in a coordinate file
File Name: \lsp\crdutil.arx

Scale Points

Function

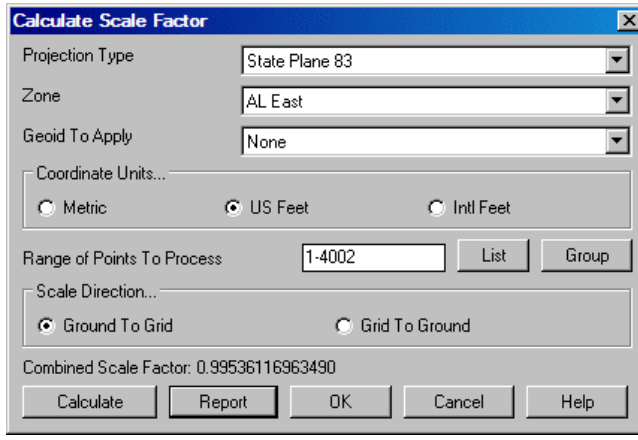
This command scales points in a coordinate file. The northing, easting and optionally the elevation are multiplied by the specified scale factor. You can use this routine for Metric-English conversion or a specific conversion by choosing the Use Customized Scale Factor option and specifying the desired Scale Factor in the edit box.



Specify the **Range of Points** to scale by entering in a range or group to scale. You can access the group dialog box by typing "group" in the range of points field.

The **Description Match** option only scales points with the description(s) specified in this field.

The **Scale Factor** is to be entered in manually when using a customized scale factor. If converting from standard measurement units, feet to meters, meters to feet, US Feet to International Feet, etc., the scale factor will be calculated and entered automatically. If a combined scale factor is required for converting from ground to grid and grid to ground coordinates, this value can be calculated by using the **Calculate Combined Factor** option. This calculation process begins with the Calculate Scale Factor dialog shown below.



The **Projection Type** must be specified as either State Plane 83 or State Plane 27 as well as what state plane **Zone** is required.

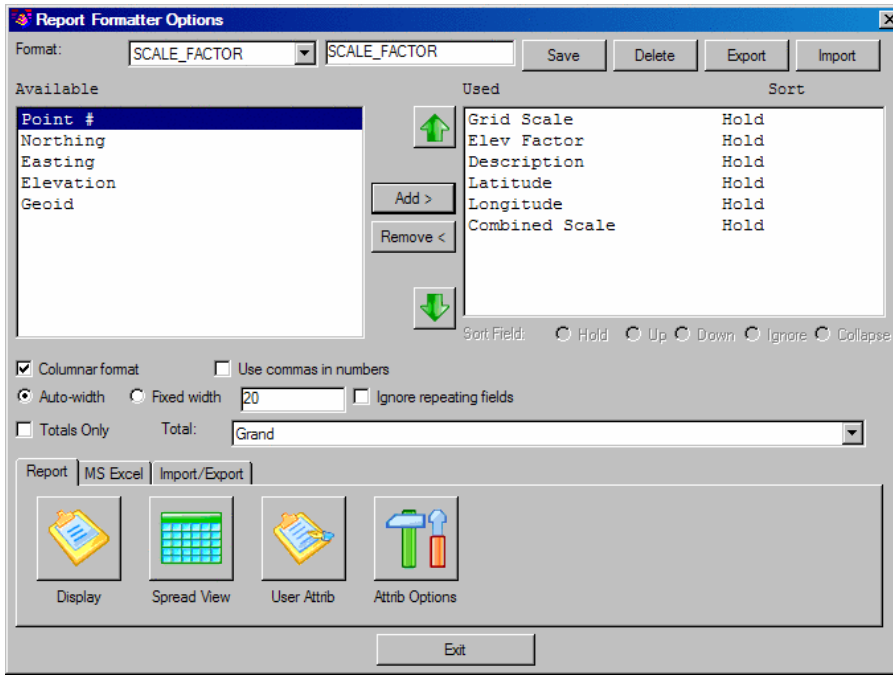
The available **Coordinate Units** are Metric, US Feet and International (Intl) Feet. The correct unit must be specified before calculating the combined scale factor.

The **Range of Numbers** to Process should be used to select the points to be used in order to calculate the combined scale factor. This does not specify what points are going to be scaled by the resulting scale factor. These points can be selected from a list by selecting the **List** button.

Scale Direction determines which way the scale factor will be calculated. A scale for **Ground to Grid** or **Grid to Ground** can be calculated and applied.

Pressing the **Calculate** button will calculate and then display the combined scale factor on the dialog box. To accept this value as the customized scale factor to use to scale the points in the coordinate file, press the **OK** button.

The **Report** option displays a report showing specified information. This information is specified by using the report formatter found throughout the program. Simply choose the information you wish to display and the order to be displayed. For further instruction and information on the Report Formatter please refer to the Report Formatter section of this manual.



With **Align Scale Entities** checked ON, after specifying the point range or group to scale and selecting OK on the dialog box the following command line prompt is displayed:
Select objects to scale (points excluded):
At this prompt select the objects on the screen, polylines, lines, arc, etc., to also scale and press enter. The points and screen entities will be now be scaled and updated graphically and in the active coordinate file.

With **Use Customized Scale Factor** Off, various conversions can be performed by specifying

the Source Coordinate units and the Destination Coordinate units. This is a quick and easy way to perform Metric/English conversions.

Pulldown Menu Location: Points
Keyboard Command: scalept
Prerequisite: points in a coordinate file
File Name: \lsp\crdutil.arx

Move Points

Function

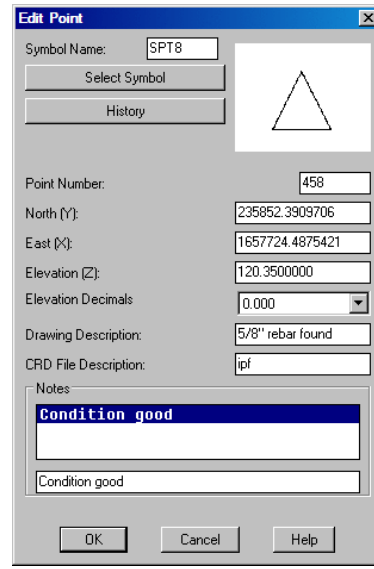
This command allows you to move Carlson points, one at a time by selecting any part of the point. Each Carlson point is made of three entities: an AutoCAD POINT entity, a symbol, and a point block with the point number, elevation and description. All these parts of the point are moved together with this routine. Any point moved using this command will result with the active coordinate file updated with the new position of the point.

Pulldown Menu Location: Points
Keyboard Command: mpnt
Prerequisite: Carlson points
File Name: \lsp\mpnt.lsp

Edit Point Attributes

Function

This command will edit the attributes of a Carlson point, such as the symbol type, point number, elevation and description. When this command is invoked, the command line will prompt the user: **Select point to edit (Enter to end).** At this point, you can select any part of the point including the symbol, elevation, point number or the description. Next, a dialog will appear as shown.



To change the symbol, either type in a new symbol name in the edit box, or choose the "Select Symbol" button where you can choose from a list of symbols. To change any of the other properties of the point, simply change or replace the contents of the edit box with the new information. Both Drawing Description and CRD File Descriptions are displayed. When a change to the Drawing description is made, this change will not be reflected in he coordinate file. This allows the change of a description that is defined in the Field to Finish (fld) table for a particular code. If a change is made in the CRD File description, it will be reflected in the coordinate file. Take note that if the CRD file description is changed, running Field to Finish will change the definitions for the point(s) changed. If you change the point number to a number that already exists in the current CRD file, and point protect is ON, you will be prompted **[O]verwrite w/new coordinates, overwrite [A]ll, or use number <1000>:.** You can choose to use the next available point number in the CRD file (this is the default), or overwrite the point number. The properties that you modify, with the exception of Drawing Description, will update the current CRD file. All modifications will update screen entities. Selecting the History button will bring up another dialog box that displays the point history of the point chosen. A history of the point will be listed, but only if, under General Setting, the Maintain CRD History File had been set to ON (selected) for the coordinate file that you are working with. With the CRD History feature of Carlson, all point changes can be rolled back.

You may also choose to use the AutoCAD *DDATTE* command to change the attributes of a point.

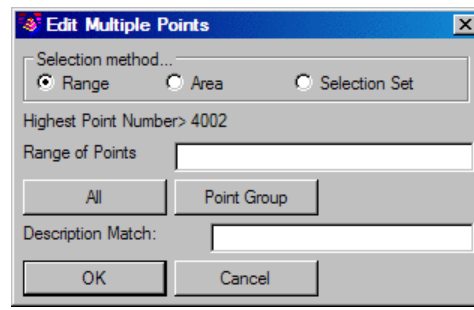
If you do this, then the CRD file will not be updated and if you change the elevation attribute, the point will not change its current Z location.

Pulldown Menu Location: Points
Keyboard Command: editpnt
Prerequisite: Carlson points
File Name: \lsp\editpnt.lsp

Edit Multiple Pt Attributes

Function

This function allows you to modify the properties of multiple point attributes at the same time. This command gives you complete control over the Carlson point attributes that are present in the drawing. Changes can be made to each attribute – the point number, elevation, description or symbol – all in one motion. For example, you could rotate the elevation text of some points to 45 degrees, change the height of the description text for all the points in the drawing, or change the layer for a particular attribute. Once this command is chosen, the entry Edit Multiple Points dialog, a smaller box, appears. Here you can determine your point selection method. There is also an option for description matching.

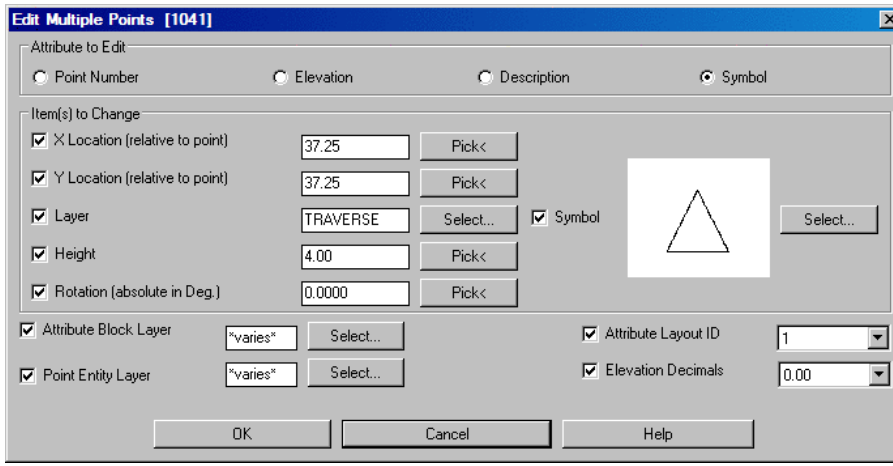


After the selection of the points to change, click OK, and the subsequent, larger Edit Multiple Points dialog boxes will appear. The number of points selected will be shown at the top of the dialog boxes.

Edit Multiple Points dialog

For each attribute, you can change any number of the properties, including the layer, height and

rotation. These dialogs will reflect the current status of each attributes properties. If, for example, you select 10 points, and 5 of them have the elevation rotation set at 45 degrees, and the other 5 are set at 0 (zero) degrees, then the rotation edit field will say ∗varies∗ to let you know that the properties of the points you selected are not the same. Here is an example of the dialog box.



The **X location** refers to the distance in the X direction from the center (or insertion point) of the point symbol. The **Y location** refers to the distance in the Y direction from the center (or insertion point) of the point symbol.

The **Layer** refers to the layer of the individual attribute, not the entire attribute block. To change the layer of the entire attribute block, use the **Attribute Block Layer** option. The **Height** is expressed in real units (generally feet or meters), not plotted size. The **Rotation angle** is expressed in absolute decimal degrees. The **Point Entity Layer** refers to the layer that the node of the point resides. The required layers can either be typed in manually, or the Select button can be used to pick from the existing layers in the drawing. If a new layer is desired, simply type in the name of the new layer and it will be created automatically. Use the layer property manager to edit the properties of this new layer, if required.

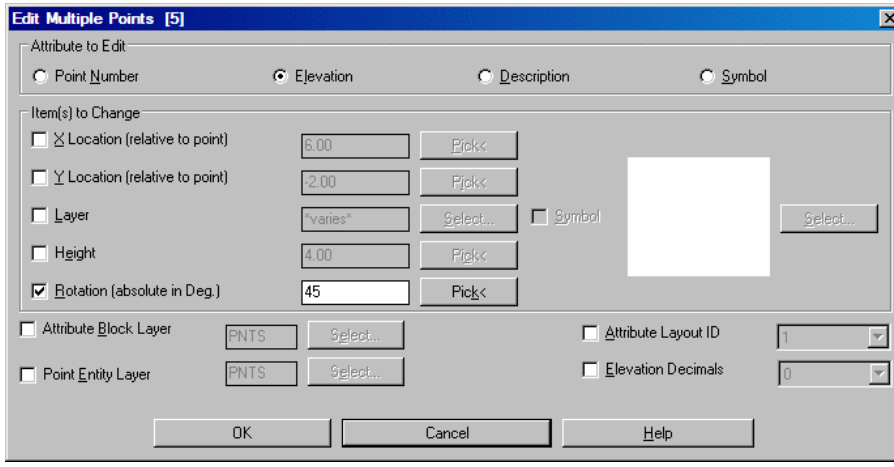
To change a point symbol, check on the **Symbol** option and use the select button to choose the desired symbol. The **Attribute Layout ID** refers to the attribute layout style defined in Point Defaults or Field to Finish code definitions. This option allows you to change the particular layout with one of the other available styles or to a customized style if defined. The Pick buttons

allow you to pick two points to define a distance (or angle in the case of Rotation). If you want to select a line to define a distance or angle, select two points on the line with the appropriate OSNAP.

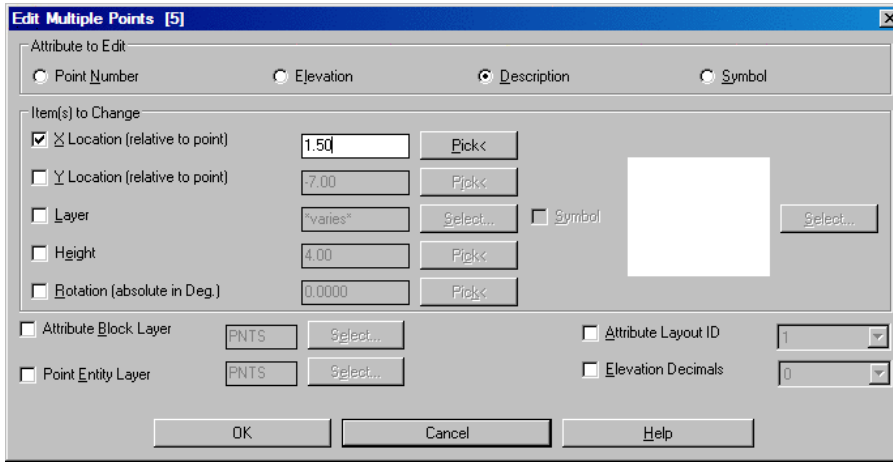
Each change to an attribute is defined separately. Select the attribute to edit, make the necessary changes to this attribute and then move on to the next attribute if required. Changes made to the attributes are remember individually, which allows for switching back and forth though the attributes until the command is completed. After completion the new settings for the point attributes will be retained until changed or redrawn on the screen.

Edit Multiple Points dialog

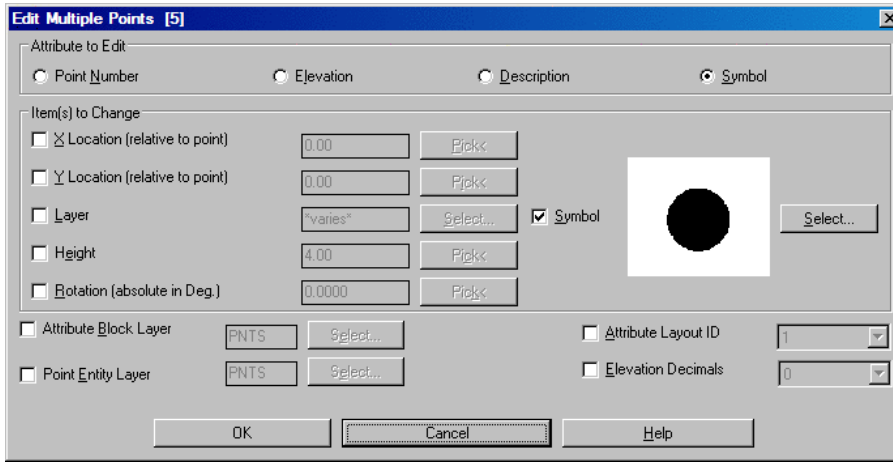
Again, the number of points selected will be shown in the dialog title. Let's now define the changes for each attribute individually. In the following example, suppose we want to rotate the elevation text to a 45 degree angle, move the description to the right and change the symbol. First, click on the Elevation for the Attribute to Edit. Now, select the Rotation option and type in 45. The dialog box should be as below.



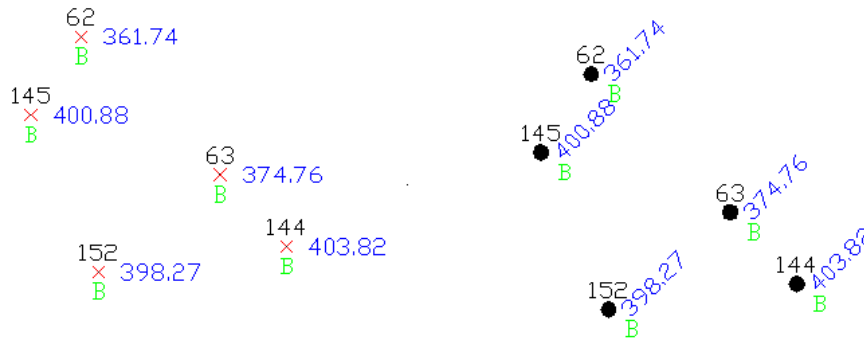
Now, select the Description option for the Attribute to Edit. Select the X location from the Items to Change. Enter 1.50 in the box. This value makes the description line up better with the rotated elevation. The dialog should be as below:



Now, for the final change, select the Symbol for the Attribute to Edit. We want to actually change the point symbol. To do this, toggle on the option to change the symbol by clicking in the box beside the word Symbol. Next, press the Select button and select symbol SPT5. The dialog should be as below:



At this point we are ready to select the OK button to perform the changes. The following image shows the points before and after the changes.



Before and After Changes

Pulldown Menu Location: Points
Keyboard Command: modpnts
Prerequisite: Points drawn on the screen
File Name: \lsp\crdutil.arx

Move Point Attributes Single

Function

This command allows the user to move Carlson point attributes (including the point number, elevation or description) one at a time.

Prompts

Select Point Number, Elevation, or Description to Move: *select point attribute*

Pick new location: *pick point*

Pick new angle: *pick new angle or press Enter*

Pulldown Menu Location: Points
Keyboard Command: movepnt
Prerequisite: Carlson points
File Name: \lsp\surv1.lsp

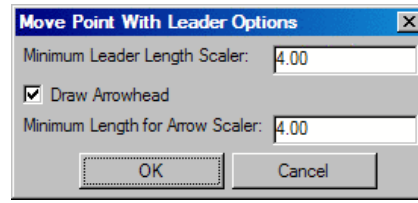
Move Point Attributes with Leader

Function

This command allows the user to move Carlson point attribute (including the point number, elevation or description) and to draw a dynamic leader to the point node. Leaders and arrowheads may be customized by selecting Options at the command line. The attributes are always justified left or right depending on which side the leader starts.

Prompts

Select Point Label to Move (O for Options): *select point attribute*
Pick label position: *pick point*
Select another Point Label to Move (O for Options,Enter to End): *O*



Minimum Leader Length Scaler: Specifies the minimum length, in terms of multiples of the attribute block's height, that the leader must be.
Draw Arrowhead: Specifies whether or not to draw an arrowhead at the end of the leader that points to the point entity.
Minimum Leader for Arrow Scaler: Specifies the minimum length of the leader, in terms of multiples of the attribute block's height, that the leader must be before an arrowhead is placed on it.

Pulldown Menu Location: Points
Keyboard Command: movepntleader
Prerequisite: Carlson points
File Name: \lsp\

Scale Point Attributes

Function

This command will scale point attribute text (number, elevation and descriptions) and point symbols up or down in size. The routine prompts for a scale multiplier and a selection set of objects. If you want to enlarge, enter a value greater than one. If you want to reduce, enter a decimal fraction such as .5. This would reduce the text size by 50%. This command is very useful if you have set up your drawing for one plotting scale and decide to change to a new plotting scale. This command has the added benefit that it will adjust the point attributes and symbols to a new screen twist angle.

Prompts

Scaling Multiplier <0.500>: *2.5* This response would enlarge the point attributes and symbols by 250 percent.
Scale symbols only, point labels only or both [Symbols/Labels/<Both>]? *press Enter*
Select points from screen, group or by point number [<Screen>/Group/Number]? *press Enter*
Select Carlson Software points. *pick a point*
Select objects: Specify opposite corner: *pick a point*
Scaling Carlson Software Point Attributes ....
Number of entities changed> 174

Pulldown Menu Location: Points
Keyboard Command: pntenl
Prerequisite: Carlson points
File Name: \lsp\pntenl.lsp

Erase Point Attributes

Function

This command allows you to erase point attributes like the number, elevation or description individually by picking on the attribute to erase.

Prompts

Select Point No., Elev, or Desc to Erase: *select point attribute*

Pulldown Menu Location: Points
Keyboard Command: erasepnt
Prerequisite: Carlson points
File Name: \lsp\surv1.lsp

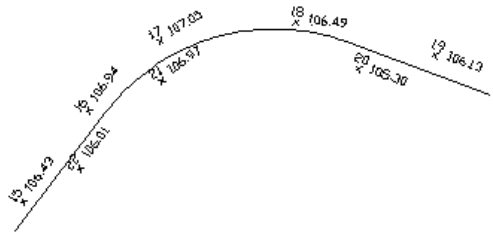
Twist Point Attributes

Function

This command will rotate the orientation of the text of Carlson point attributes (point #, elevation, description) and point symbols. The Twist Screen option aligns the point attributes to appear horizontal in the current twist screen. The Azimuth option allows you to enter an azimuth or pick two points to align the point attributes. The Entity Segment option aligns the point attributes by the selected line or polyline segment in the direction the entity is drawn. The Follow Polyline option aligns the point attributes by the polyline segment that is closest to the point.

Prompts

Twist by [<Twist screen>/Azimuth/Entity segment/Follow polyline]? *F*
Select reference polylines to follow. *pick a polyline*
Select objects: 1 found
Select objects:
Select points from screen, group or by point number [<Screen>/Group/Number]? *select Enter*
Select Carlson Software points.
Select objects: *pick the Carlson point inserts*



Point attributes aligned by Follow Polyline option of Twist Point

Pulldown Menu Location: Points
Keyboard Command: twistpts
Prerequisite: None
File Name: \lsp\twist_pt.lsp

Resize Point Attributes

Function

This command sets the size of the selected point attributes (point number, elevation, description) and point symbols. This command is similar to Scale Point Attributes, but instead of scaling the size by a factor, all the select points are set to the same specified size. Points can also be chosen based upon Point Groups.

Prompts

Enter point attribute and symbol size <4.0>: *press Enter*
Scale symbols only, point labels only or both [Symbols/Labels/<Both>]? *press Enter*
Select points from screen, group or by point number [<Screen>/Group/Number]? *press Enter*
Select Carlson Software points.
Select objects: *pick the point entities*
Finding Carlson Software Point Attributes ....
Number of entities changed> 10

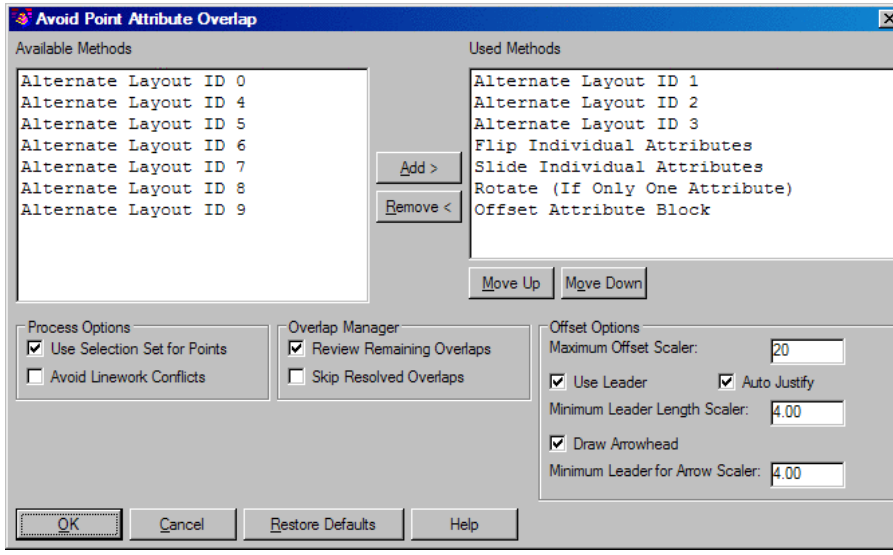
Pulldown Menu Location: Points
Keyboard Command: sizepnt
Prerequisite: Carlson points
File Name: \lsp\sizepnt.lsp

Fix Point Attribute Overlaps

Function

This command is to be used to adjust point attribute labels to avoid overlapping labels. It applies adjustment methods based upon user-specified ordering and tolerances. The command steps you through any remaining overlaps in an Overlap Manager, which includes the capability to manually move labels. This point overlap feature is also available within the Draw-Locate Point

and Field To Finish commands.



Methods: There are different methods of automatically solving a point attribute overlap. The methods will be applied in order from top to bottom on the Used Methods list. Unused methods appear on the Available Methods list. The methods are:

Alternate Layout ID 0-9

These methods will simply apply the specified attribute layout ID and then check to see if the attributes of the point in question still overlap. The different attribute layout IDs can be seen in the *Point Defaults* command on the Points menu.

Flip Individual Attributes

This method tests each attribute (point #, description, and elevation) by flipping it or mirroring it the other side of the point. The mirror is the vertical axis of the text that goes through the point entity. This method is not applied to points that have a leader.

Slide Individual Attributes

This method tests each attribute (point #, description, and elevation) by sliding it back and forth. The maximum distance the attribute will be moved is the horizontal length of the text. This method is not applied to points that have a leader.

Rotate (If Only One Attribute)
This method is applied if there is only one point attribute, either point #, description, or elevation. The one attribute is rotated around the point entity to see if the point overlap can be fixed.

Offset Attribute Block
This method is arguably the most powerful method and can solve any overlap by moving the attribute block far enough. See *Offset Options* below for a description of the options that can be used with this method.

Offset Options: These are the options that apply to the Offset Attribute Block method of automatically solving point attribute overlaps.
Maximum Offset Scaler: This specifies the maximum distance, in terms of multiples of the attribute block's height, that the attribute block may be offset from the point entity.
Use Leader: Specifies whether or not a leader should be drawn when offsetting the attribute block.
Minimum Leader Length Scaler: Specifies the minimum length, in terms of multiples of the attribute block's height, that the leader must be.
Draw Arrowhead: Specifies whether or not to draw an arrowhead at the end of the leader that points to the point entity.
Minimum Leader for Arrow Scaler: Specifies the minimum length of the leader, in terms of multiples of the attribute block's height, that the leader must be before an arrowhead is placed on it.

Use Selection Set for Points: Check this checkbox to be given the option of selecting which points in drawing to fix overlaps with. If not checked, then all the points in the drawing are used.

Avoid Linework Conflicts: Check this checkbox to prevent point attributes from overlapping linework in addition to other point attributes.

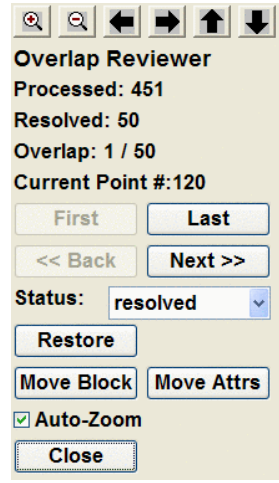
Review Remaining Overlaps: Check this checkbox to have the Overlap Reviewer dockable dialog come up after the automated process finishes. The Overlap Reviewer allows for reviewing the automated fixes as well as tools for manually fixing any remaining overlaps. See Overlap Reviewer below for more information.

Skip Resolved Overlaps: Check this checkbox to skip overlaps that were automatically resolved and to only review unresolved overlaps. If not checked, then both resolved overlaps and

unresolved overlaps will be available for review. This option only applies if Review Remaining Overlaps is on.

Overlap Reviewer

The Overlap Reviewer will come up after automatic overlap fixing if the Review Remaining Overlaps checkbox was checked. This tool displays how many points were found, how many overlaps were fixed, which overlap is currently being viewed, how many overlaps there were total, and the point # of the current overlap. Use the First, Last, Back, and Next buttons to navigate forwards and backwards through the list of overlaps. Use the Move Block and Move Attrs buttons to manually move either the entire attribute block or individual attributes.



Pan and Zoom Controls: Use the buttons on the top to help zoom in and out and pan the drawing around. You can also use the standard mouse controls for panning and zooming.

First, Last, Back, and Next: These buttons allow you to step through each overlap or to jump to the first or the last.

Status: This drop-down list indicates the status of the current overlap. *open* means that the overlap has not been fixed yet. *resolved* means that the overlap has been fixed. *ignore* can be chosen by you to remove the overlap from the list.

Restore: Restores the attributes of the current point to their original location and rotation from before the Fix Point Attribute Overlaps command was run.

Move Block: Allows you to move one or more attribute blocks in the drawing. See the documentation for *Move Point Attributes with Leader* command in the Points menu.

Move Attrs: Allows you to move and rotate one or more indvidual attributes in the drawing. See the documentation for *Move Point Attributes* command in the Points menu.

Auto-Zoom: Check this checkbox to automatically zoom and pan the view as each overlap is viewed.

Prompts

The following prompt will be displayed if the Use Selection Set for Points checkbox is on and OK is pressed.
Select the points to fix overlaps with: *pick the Carlson point inserts*

Pulldown Menu Location: Points
Keyboard Command: overlappts
Prerequisite: None
File Name: \lsp\

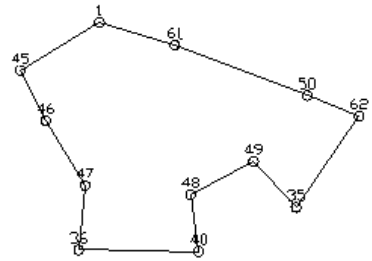
Trim by Point Symbol

Function

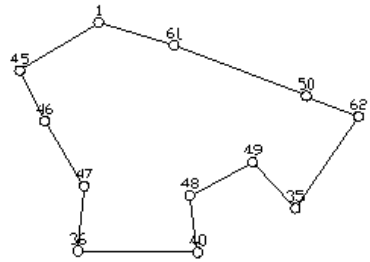
This command will trim lines and polylines that pass through the selected point symbols such that the lines do not appear within the symbol. This should be a last step because this routine explodes the points and modifies the lines and polylines by trimming which makes these entities unusable by some of the other COGO routines.

Prompts

Select Carlson Software point symbols to trim against.
Select objects: *select the point symbols*



Before Trim by Point Symbol



After Trim by Point Symbol

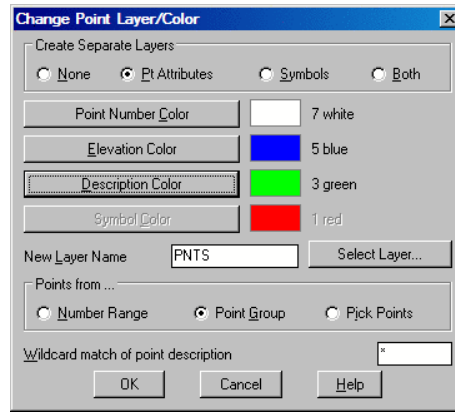
Pulldown Menu Location: Points
Keyboard Command: trimpts
Prerequisite: Carlson point symbols
File Name: \lsp\trim_pts.lsp

Change Point LayerColor

Function

This command changes the layer and optionally the color of Carlson points. The points are initially put in the layer set in Point Defaults. The symbol, point number, elevation and description are in the layers PNTMARK, PNTNO, PNTELEV, and PNTDESC. To change the point attribute colors, this routine creates new attribute layers based on the new layer name. For example if the new layer name was TRAV, then the resulting layers would be TRAVMARK, TRAVNO, TRAVELEV and TRAVDESC. These new layers can be given different colors. To select an attribute color, pick on the color button. To permanently change attribute colors, edit

the drawing SRVPNO1.DWG in the Carlson SUP directory. To permanently change a symbol color, edit the symbol drawing itself.



The selection of the points to change can be accomplished in three ways. A number range selection would require the input of the range of points to change. An example would be 1-20,25,30, 32-36. Points groups can also be used as a selection method. Simply specify the point group name to change, when prompted, and all the points included in that group will be changed. The final selection method is that of Pick Points. Using this method a prompt to select objects is displayed. When prompted select the points to change from the screen.

Pulldown Menu Location: Points
Keyboard Command: pntchg
Prerequisite: Carlson points displayed in the graphic drawing window
File Name: \lsp\pntchg.lsp

Renumber Points

Function

This command will edit the point number attributes of a group of Carlson points. The command prompts for the user to enter the point number difference. Enter the positive or negative amount you would like to have added/subtracted from the current value. After selecting the point to change, a prompt to delete the old point number is displayed. If yes is chosen the old point

number is deleted from the CRD file, if no is selected the old and new point numbers are retained in the file. This results in one coordinate position represented by two point numbers.

The following illustrates number changes from point 4, 5 and 6 to 104, 105 and 106. This prompt sequence retains both numbers in the CRD file. If the intent is to renumber and delete the original points 4, 5 and 6, then Yes would be selected when prompted to Delete old point numbers.

Prompts

Positive number increases, negative number decreases Point number.
Point Number difference <1>: *100* This response would add 100 to the current point number value.
Select Carlson Software Points for Point Number change.
Select objects: *select a point number or a group of points by window or crossing*
Delete old point numbers from file [<Yes>/No]? Choose correct response. In this example the response was N, leading to the following.
PT#: 6 changed to PT#: 106..
PT#: 5 changed to PT#: 105..
PT#: 4 changed to PT#: 104..
Number of entities changed: 3

Pulldown Menu Location: Points
Keyboard Command: renumpt
Prerequisite: Carlson points
File Name: \lsp\renumpnt.lsp

Explode Carlson Points

Function

This command can be useful if you need to send your drawing to another firm who does not have AutoCAD/Carlson. Drawing transfer problems occur when the recipient does not have the same block/inserts defined or available. This command explodes all blocks and replaces the Carlson point attributes with TEXT entities of the same value. After the points have been selected, a prompt for the layer name for each point attribute will be displayed. Point Numbers, Point Elevations and Point Descriptions can be put on user specified layers, or the default for each prompt can be selected. **Caution:** After using this command, the link between the points and the

coordinate file are destroyed and you can no longer extract the attributes from the drawing. If you want to use this command but retain your point information, follow these steps:

1. Save your drawing
2. Run this command to explode the points
3. Execute the SAVEAS command and save the drawing as a different name (you can also choose DXF format if you wish).
4. Exit the drawing **without** saving.

Prompts

This command will explode selected Carlson Software point blocks and replot the attributes as Text entities!
The resulting points will NOT be useable by most Carlson Software commands!!!!
Select Carlson Software Points to Explode. *select points*
Layer Name for Point Numbers <PNTNO>: *press Enter*
Layer Name for Point Elevations <PNTELEV>: *press Enter*
Layer Name for Point Descriptions <PNTDESC>: *press Enter*
Number of entities changed> 345

Pulldown Menu Location: Points
Keyboard Command: explode_scad
Prerequisite: Carlson points
File Name: \lsp\scexp.lsp

Convert Surveyor1 to CRD

Function

This command will convert a Surveyor1 coordinate file to the current Carlson format.

Pulldown Menu Location: Points > Convert Point Format
Keyboard Command: SURVEYOR2CRD
Prerequisite: A Surveyor1 coordinate file

Convert CRD to TDS CR5/Convert TDS CR5 to CRD

Function

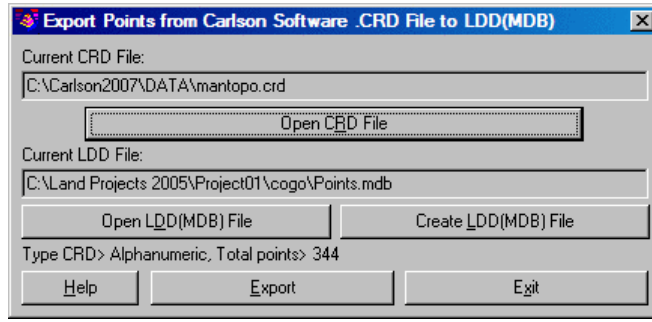
These commands convert coordinate file formats between a Carlson CRD file and a TDS CR5 file. Both of these file formats are binary which require these special routines. These commands will prompt for the file names to process.

Pulldown Menu Location: Points
Keyboard Commands: crd_cr5, cr5_crd
Prerequisite: A CRD or CR5 file
File Name: \lsp\cogoutil.arx

Convert CRD to Land Desktop MDB

Function

This command converts a Carlson CRD file into an Autodesk Land Development Desktop (LDD) point database file in Access MDB format. The LDD point database always has the file name of POINTS.MDB. So, to specify the LDD file to create, you only need to specify the directory/path and not the file name. This path corresponds to the LDD project directory. The conversion program has point protect, so that if a point number from the CRD file already exists in the LDD file, you then will be prompted to skip or replace the point. Once the command is executed, the following dialog is displayed. On this dialog, specify the Carlson CRD file to convert as well as the LDD (MDB) file to append, if existing, or create if creating a new LDD (MDB) file.

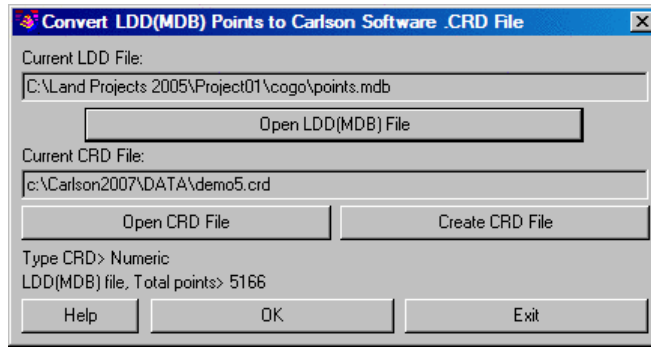


Pulldown Menu Location: Points > Convert Point Format
Keyboard Command: crd_ldd
Prerequisite: A .CRD file
File Name: \lsp\gisutil.arx

Convert Land Desktop MDB to Carlson Points

Function

This command converts an Autodesk Land Development Desktop (LDD, also referred to as LDT) point database file into a Carlson CRD file. The LDD point database always has the file name of POINTS.MDB and is stored in the LDD project directory. Once the command is executed, the following dialog is displayed. On this dialog, specify the LDD file to convert as well as the Carlson CRD file to append, if existing, or create if creating a new CRD file.

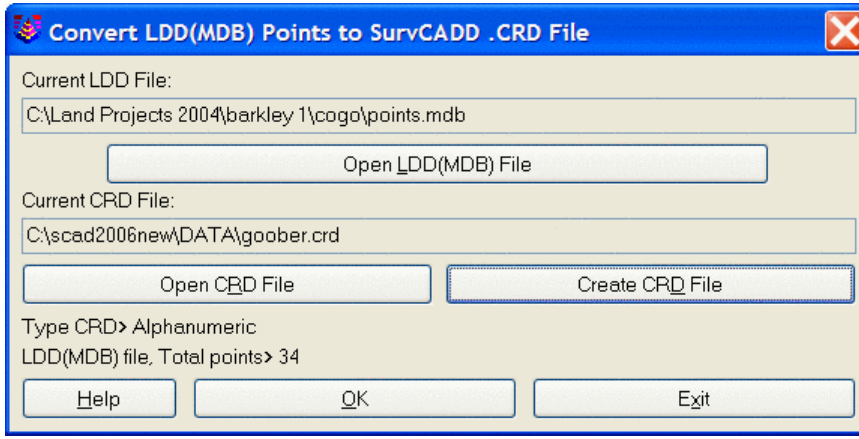


Pulldown Menu Location: Points > Convert Point Format
Keyboard Command: LDD_crd
Prerequisite: An LDD point database file
File Name: \lsp\gisutil.arx

Convert Civil 3D to Carlson Points

Function

This command converts an Autodesk Land Development Desktop (LDD) point database file into a Carlson CRD file. The LDD point database always has the file name of POINTS.MDB and is stored in the LDD project directory. Once the command is executed, the following dialog is displayed. On this dialog specify the LDD file to convert as well as the Carlson CRD file to append, if existing, or create if creating a new CRD file.



Pulldown Menu Location: Points
Keyboard Command: ldd_crd
Prerequisite: An LDD point database file
File Name: \lsp\gisutil.arx

Convert Carlson Points to Land Desktop

Function

This command converts a Carlson CRD file into a Land Desktop point file. To do this, you must specify the existing Carlson CRD points to convert. You have the option of selecting all points, or selecting on-screen the specific points you'd like to convert.

Prompts

Convert all or selected points [All/<Selected>]? *press Enter*
Select Carlson Software Points to convert:
Select objects: *pick first point for window selection method*
Select objects: *pick second point*
Processing Carlson Software point...

Pulldown Menu Location: Points > Convert Point Format
Keyboard Command: pt_aec
Prerequisite: A Carlson CRD file

Convert Softdesk to Carlson Points

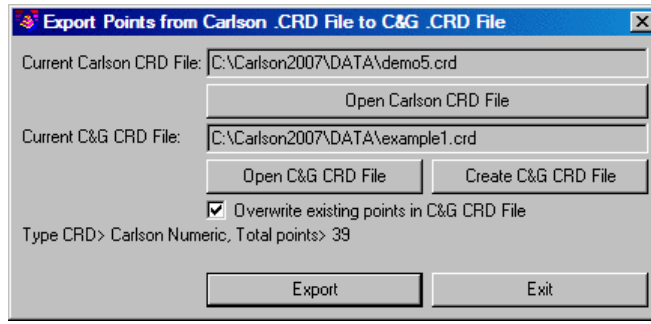
Function

This command converts Softdesk point blocks in the drawing to Carlson point blocks. These point block formats are similar and converting only requires reordering and renaming the attributes. Softdesk points can also be read into the current CRD file by using the command *Update CRD File from Drawing* in *Coordinate File Utilities,* this updates the CRD file without modifying the screen entities.

Pulldown Menu Location: Points > Convert Point Format
Keyboard Command: 2surv
Prerequisite: Softdesk points
File Name: \lsp\2surv.lsp

Convert Carlson Points to C&G

This command converts a Carlson CRD file into a C&G Point file.

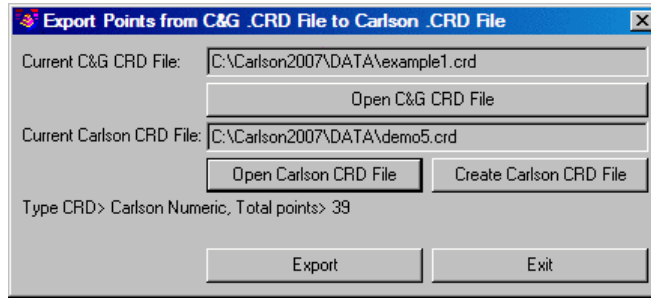

Export Points from Carlson .CRD File to C&G .CRD File
Current Carlson CRD File:
C:\Carlson2007\DATA\demo5.crd
Open Carlson CRD File
Current C&G CRD File:
C:\Carlson2007\DATA\example1.crd
Open C&G CRD File
Create C&G CRD File
Overwrite existing points in C&G CRD File
Type CRD> Carlson Numeric, Total points> 39
Export
Exit

Specify the existing Carlson CRD to convert by selecting the Open Carlson CRD File button. Specify the existing C&G CRD file to write to, or the new C&G CRD file to create, by selecting either Open C&G CRD file or Create C&G CRD file. Press OK and the conversion is completed.

Pulldown Menu Location: Points > Convert Point Format
Keyboard Command: crd2cg
Prerequisite: A Carlson CRD file

Convert C&G to Carlson Points

This command converts C&G Points into a Carlson CRD file.



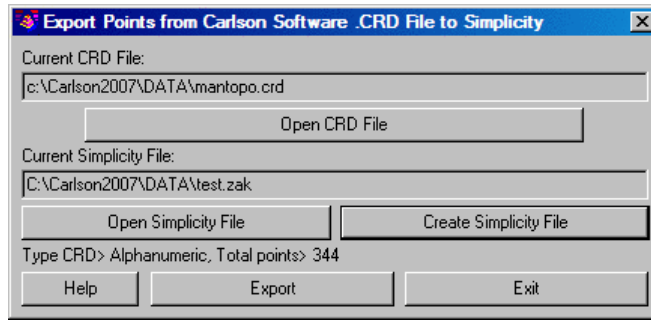
Specify the existing C&G File to convert by selecting the Open C&G CRD File button. Specify the existing Carlson CRD file to write to, or the new Carlson CRD file to create, by selecting either Open Carlson CRD file or Create Carlson CRD file. Press OK and the conversion is completed.

Pulldown Menu Location: Points > Convert Point Format
Keyboard Command: cg2crd
Prerequisite: A C&G point file

Convert Carlson Points to Simplicity

Function

This command will convert Carlson points to Simplicity.



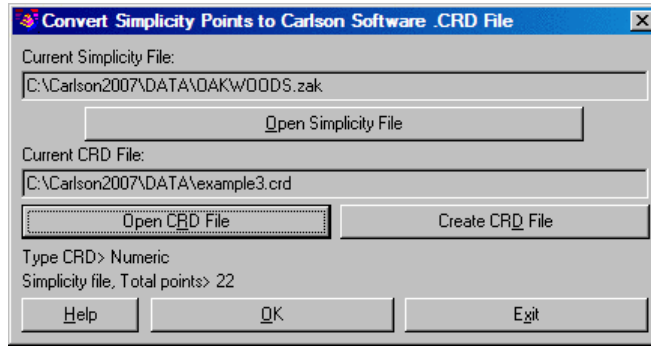
Select Carlson CRD file to convert by selecting the Open CRD file button.

Specify the existing Simplicity file to write to, or the new Simplicity file to create, by selecting either Open Simplicity File or Create Simplicity File. Press Export and the conversion is completed.

Pulldown Menu Location: Points > Convert Point Format
Keyboard Command: crd_zak
Prerequisite: A Simplicity point file

Convert Simplicity to Carlson Points

This command converts Simplicity Points into a Carlson CRD file.



Specify the existing Simplicity File to convert by selecting the Open Simplicity File button. Specify the existing Carlson CRD file to write to, or the new Carlson CRD file to create, by

selecting either Open CRD File or Create CRD File. Press OK and the conversion is completed.

Pulldown Menu Location: Points > Convert Point Format
Keyboard Command: zak_crd
Prerequisite: A Simplicity point file

Convert Leica to Carlson Points

Function

This command converts LisCad or Leica point blocks in the drawing to Carlson point blocks. These point block formats are similar and converting only requires reordering and renaming the attributes. Leica points can also be read into the current CRD file by using the command *Update CRD File from Drawing* in *Coordinate File Utilities.* This updates the CRD file without modifying the screen entities.

Pulldown Menu Location: Points > Convert Point Format
Keyboard Command: 2surv3
Prerequisite: Leica points

Convert Geodimeter to Carlson Points

Function

This command converts Geodimeter point blocks in the drawing to Carlson point blocks. These point block formats are similar, and converting only requires reordering and renaming the attributes. Geodimeter points can also be read into the current CRD file by using the command *Update CRD File from Drawing* in *Coordinate File Utilities.* This updates the CRD file without modifying the screen entities.

Pulldown Menu Location: Points > Convert Point Format
Keyboard Command: 2surv4
Prerequisite: Geodimeter points

Convert Carlson Points to Ashtech GIS

Function

This command converts Carlson point blocks in the drawing to Ashtech GIS point blocks. After executing the command, you will be prompted to select the points to convert. When using this command, the setting "Group Point Entities", found under General Settings of the Configure command (Settings menu) should be unchecked (turned off).

Pulldown Menu Location: Points > Convert Point Format
Keyboard Command: 2ashtech
Prerequisite: Carlson Points

Convert Carlson Points to Softdesk

Function

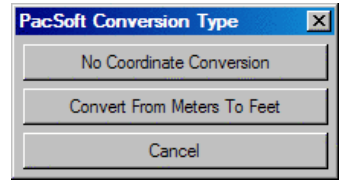
This command converts Carlson point blocks in the drawing to Softdesk point blocks. These point block formats are similar, and converting only requires reordering and renaming the attributes.

Pulldown Menu Location: Points > Convert Point Format
Keyboard Command: 2soft
Prerequisite: Carlson points
File Name: \lsp\2soft.lsp

Convert PacSoft CRD to Carlson CRD

Function

This command converts a PacSoft CRD file to a Carlson CRD file. PacSoft stores the point descriptions to a separate coordinate descriptor file having an extension of PTD. This file should be present in the same directory as the CRD file to convert. Prompts for the PacSoft CRD file to convert, and the Carlson CRD file to create, will be displayed. Once both files have been specified, the following dialog box will be displayed.



The **No Coordinate Conversion** option converts the file format while leaving the coordinate values unchanged.

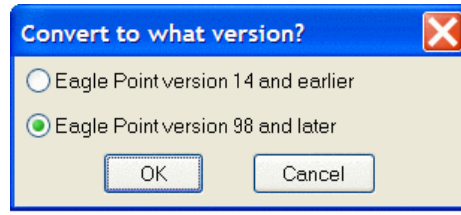
Convert From Meters to Feet will assume the coordinates in the selected PacSoft crd file are metric, and will convert the coordinate values to US Feet.

Pulldown Menu Location: Points > Convert Point Format
Keyboard Command: pacsoft2crd
Prerequisite: PacSoft crd file

Convert Carlson Points to Eagle Point

Function

This command converts Carlson point blocks in the drawing to Eagle Point point blocks. A prompt for the Eagle Point version to convert to will be displayed.



Specify the appropriate version and then select the OK button. You will then be prompted to select the Carlson points to convert. These point block formats are similar, and converting only requires reordering and renaming the attributes.

Pulldown Menu Location: Points > Convert Point Format
Keyboard Command: 2eds
Prerequisite: Carlson points

Convert Eagle Point to Carlson Points

Function

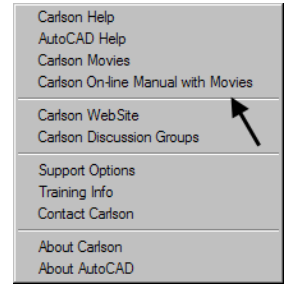
This command converts Eagle Point point blocks in the drawing to Carlson point blocks. These point block formats are similar, and converting only requires reordering and renaming the attributes. Eagle Point points can also be read into the current CRD file by using the command *Update CRD File from Drawing,* found in *Coordinate File Utilities.* This updates the CRD file without modifying the screen entities.

Pulldown Menu Location: Points > Convert Point Format
Keyboard Command: 2surv2
Prerequisite: Eagle Point points
File Name: \lsp\2surv2.lsp

Help Menu

Carlson On-line Manual with Movies

This function launches the Internet browser to view the Carlson manual on-line. This on-line manual also includes training movies. You will need a fast internet connection to use this manual.



Tutorials

This section contains a dozen tutorials designed to assist you in learning the Carlson Survey/Civil/Mining product line. They are:

Lesson 1: Entering a Deed

Lesson 2: Making a Plat

Lesson 3: Field to Finish for Faster Drafting

Lesson 4: Intersections and Subdivisions

Lesson 5: SurvNET

Lesson 6: Contouring, DTM, and Design

Lesson 7: Contouring, Break Lines and Stockpiles

Lesson 8: A Dozen Tools for Surface Design

Lesson 9: Calculate Volumes By Five Methods

Lesson 10: Basic Road Design with Volumes

Lesson 11: Hydrology and Watershed Analysis

Lesson 12: Stormwater Network Design

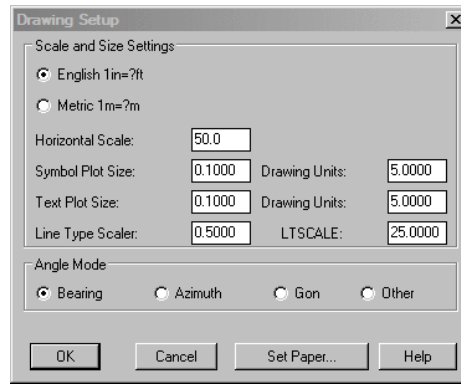
Lesson 1: Entering a Deed

In this short lesson you will create a simple drawing. You will enter a 6-sided deed, add a title block, bar scale, and north arrow, add a title and certification text, and plot the deed area.

Note that the Esc key will cancel most commands, so if you choose the wrong command or enter something incorrectly and want to start over, just press Esc.

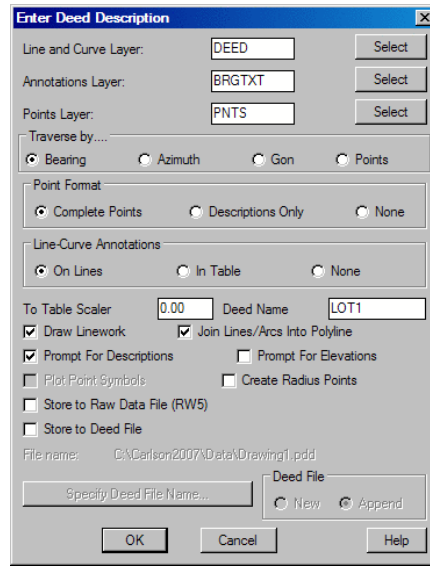
1 Click the icon for Carlson. You may be presented with a "Startup Wizard" dialog box. If so, click Exit.

2 Under the Settings menu, click *Drawing Setup*. Set the unit setting to English and the Horizontal Scale to 50. Click OK.



3 Choose *Point Defaults* from the Points menu, and, in the dialog box, click Elevations off to eliminate the Elevation prompt. Click Descriptions on and also set the point symbol name to symbol 4 (SPT4), which is the round, open circle. Click Automatic Point Numbering on. Click OK.

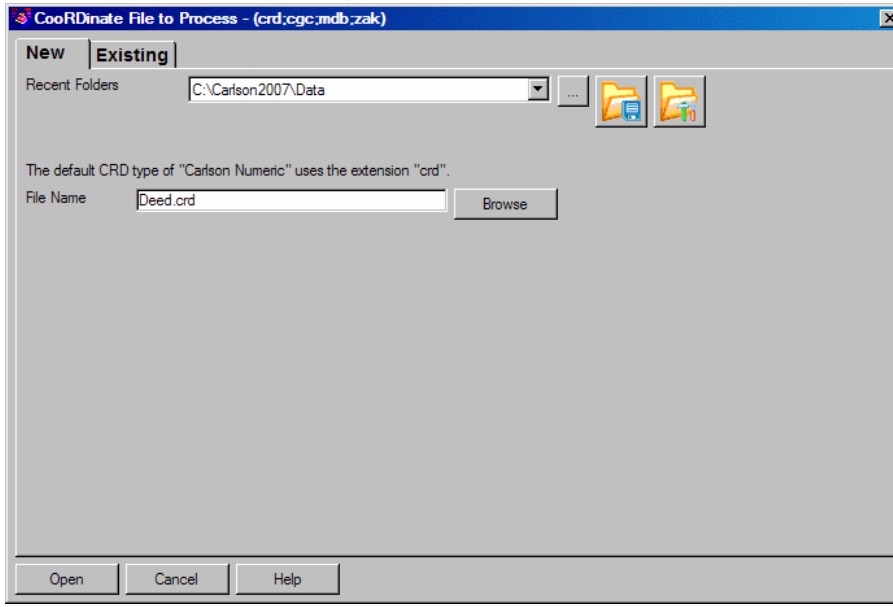
4 Under the Survey menu, select *Enter Deed Description*. Use the default settings as shown in this dialog box image.



Set the To Table Scaler option to 0.00. This places all of the deed calls in the drawing. The To Table Scaler determines which deed calls appear in the drawing and which deed calls appear in a table. Deed calls less than the To Table Scaler value multiplied by the Drawing Scale will be placed in a table of calls. Set the dialog box options to match those shown above. Click OK.

The command line is the area below the graphics and to the left. When prompted to "Pick point or point number" at the command line, pick a point in the lower left quadrant of your screen to start the deed plotting. If you are prompted for elevation, you failed to turn off the elevation prompt in *Point Defaults*. Press Esc and return to the *Point Defaults* command.

The following dialog box will appear so you can specify where to store the coordinates:



Select the New tab. Then, for the File Name, type in Deed. This creates a file called Deed.crd. All Carlson points are stored in files with the "crd" extension, which stands for "coordinates." Click Open. Now respond to the command line prompts exactly as shown here:

When you are prompted for a description, enter "Fence Post".

Exit/Curve/<Bearing (Qdd.mmss)>: 125.3500
The quadrant (Q) is 1 for Northeast (2 is Southeast, 3 is Southwest and 4 is Northwest). The bearing is 25 degrees, 35 minutes, and 00 seconds. If all digits for the minutes and seconds are entered as shown above, then the deed call will be fully plotted, including the seconds. If only the degrees and minutes were entered, as in 125.35, then the plot would appear as "N 25° 35' E".
Varas/Meters/Poles/Chains/<Distance(ft)>: 200.51 Note that you can enter old deeds in the forms of Poles and Links, Chains and Links and even Varas (a unit of measurement formerly used in the southwestern states of the U.S.).
Enter Point Description <Fence Post>: *Iron Pin*
Undo/Exit/Curve/<Bearing (Qdd.mmss)>: *189.4321*
Varas/Meters/Poles/Chains/<Distance>: *225.00*
Enter Point Description <Iron Pin>: *press Enter*
Pressing Enter selects the default, which is Iron Pin.
Undo/Exit/Curve/<Bearing (Qdd.mmss)>: *C*

Radius: *75*
Curve direction [Left/<Right>]? *press Enter* for right
Non-tangent/Reverse-tangent/Bearing/Chord/DeltaAng/Tangent/<Arc Len>: *118.17*
If you don't know the arc length, but you know the tangent, you would choose "T" for tangent.
Enter Point Description <Iron Pin>: *press Enter*
Undo/Exit/Curve/<Bearing (Qdd.mmss)>: *200.0000* (due south)
If you were to enter just 2 (no degrees, minutes, or seconds), then the deed call would be plotted "S 000 E".
Varas/Meters/Poles/Chains/<Distance>: *178.00*
Enter Point Description <Iron Pin>: *Concrete Monument*
Undo/Exit/Curve/<Bearing (Qdd.mmss)>: *488.2300*
This entry specifies Northwest 88 degrees, 23 minutes.
Varas/Meters/Poles/Chains/<Distance>: *300.34*
Enter Point Description <Concrete Monument>: *Fence Post*
Undo/Exit/Curve/<Bearing (Qdd.mmss)>: *454.1109*
Varas/Meters/Poles/Chains/<Distance>: *106.93*
Enter Point Description <Fence Post>: *press Spacebar, then press Enter*
Simply pressing Enter uses the default text (Fence Post) again. To avoid drawing the text "Fence Post" twice on the end point, press the spacebar, skip a blank character, and press Enter.
You have now completed the 6-sided figure (including one curve).
Undo/Exit/Curve/<Bearing (Qdd.mmss)>: *E*

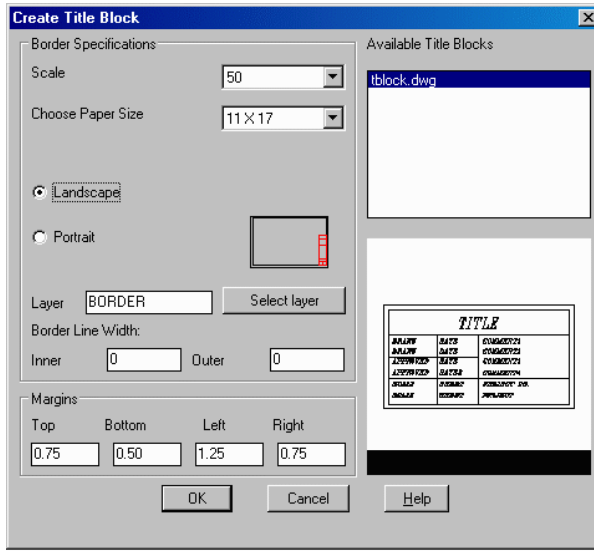
The following results are reported:

```
 SQ. FEET: 83921.8  SQ. YARDS: 9324.6  SQ. MILES: 0.0

 ACRES: 1.93

 Closure error distance> 0.01708540  Error
Bearing> S 52d5'26'' E

 Closure Precision> 1 in 66076.89  Total Distance Traversed>
1128.95

 SQ. FEET: 82302.9  SQ. YARDS: 9144.8  SQ. MILES: 0.0

 ACRES: 1.89
```

The resulting deed, has a closure of 1:66077. In the initial prozmpt "Undo/Exit/Curve...", U for Undo would allow you to reenter the previous deed call.

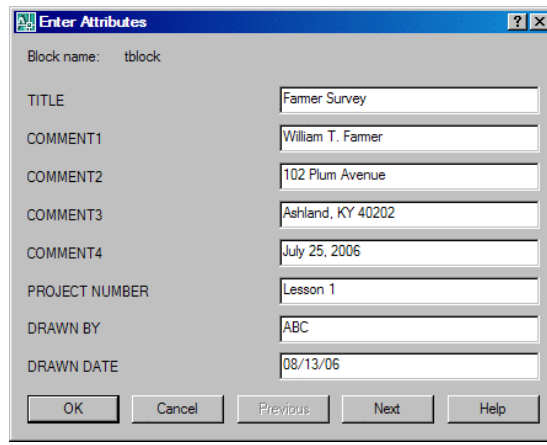
Use the Extents command on the View menu to see the entire area. Then choose *Zoom Out* under the View menu giving you adequate room for the next step.

5 Under the Settings menu, select *Title Block*. The first dialog you will see is shown here:



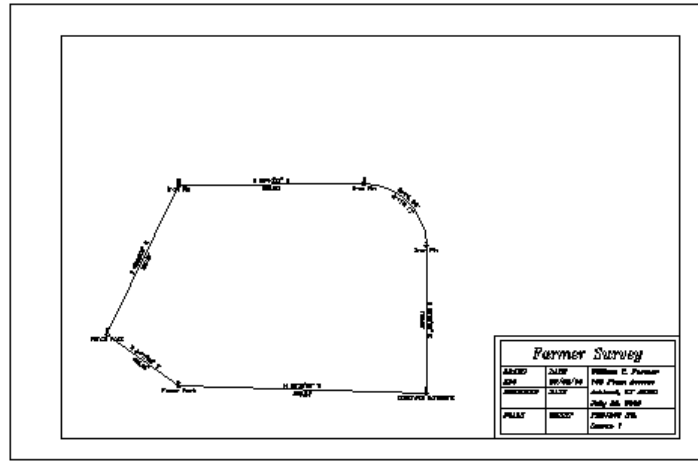
Select Paper Size B2 (11 x 17), and enter the layer name of BORDER, then choose OK. You will be prompted for the border location, pick a point in the lower left of the survey.

The following dialog appears, allowing you to enter the attributes for the Title Block. After you have completed the title block entries, as shown below, select OK.



Note that the title line is plotted in large text on the title block. Its length, therefore, should not exceed 15 characters.

Your drawing should look like the example below at this point.

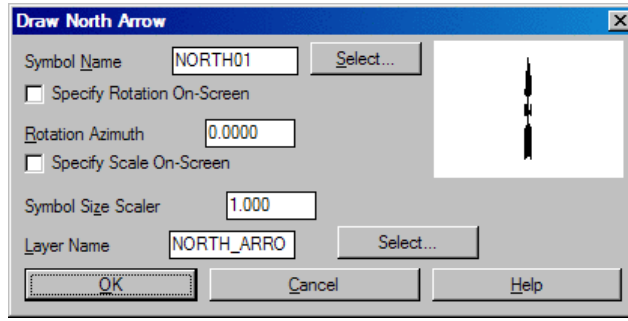


Use the *Extents* command, found in the View menu, to see the entire working area. If you want to move the border, use the *Move* command on the Edit menu. Pick the border lines and the title block objecm ts (up to 3 picks total), press Enter (to end object selection), then pick two points representing the vector of the move.

If you want to see a margin around the working area after you use the Extents command, use the Zoom Out command on the View menu. Then use the Window command on the View menu to capture the view and margin you prefer.

If you make a mistake, enter U for undo, or select the back arrow icon that appears at the top of the screen.

6 On the Annotate menu, select *Draw North Arrow*.



Accept the default north arrow that is shown at the right side of the dialog, click OK, and place it in the upper right of your drawing. Choose *Move* on the Edit menu (or Enter M for move at the command line) and move it.

7 On the Annotate menu, select *Draw Bar Scale*. Accept the defaults, and then pick an insertion point below the north arrow and directly above the "a" in Farmer, and approximately the same distance from both. You can move the bar scale using the *Move* command on the Edit menu, if you need to.

8 On the Draw menu, select *Dynamic* within the *Text* command. Respond to the prompts as shown below:

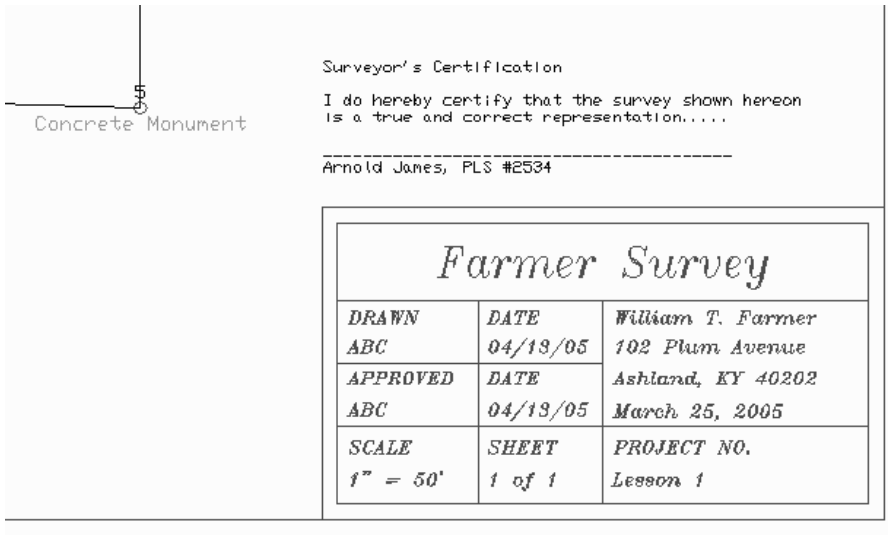
Specify start point of text or [Justify/Style]: *J*
Enter an option [Align/Fit/Center/Middle/Right/TL/TC/TR/ML/MC/MR/BL/BC/BR]: *C* for center justified
Specify center point of text: Choose a point near the top-center of the drawing.
Specify height <4.00>:10 Entering 10 make the title text bigger than the default.
Specify rotation angle of text <E>: E
Text: Farmer Survey
Text: Ashland, KY
Text: *press Enter*

To enter a certification in the lower-right of the drawing, again select Text > Dynamic from the Draw menu, or type "dtext" at the command line. If you haven't done anything else, such as Zoom or Pan, you can simply press Enter to repeat the last command. If pressing Enter does not repeat the Text command, press Esc to cancel. Enter Dtext at the command prompt, and respond to the resulting prompts as shown below.

Pick a point above and to the left of the title block for the certification. You don't have to enter L for left-justification. The Dtext command defaults to left-justification every time.

Height <10.00>: 4
Rotation angle <E>:*press Enter*
Text: Surveyor's Certification
Text: *Press spacebar, then press Enter*
Text: I do hereby certify that the survey shown hereon
Text: is a true and correct representation.....
Text: *press spacebar, then press Enter*
Text: _____
Text: Arnold James, PLS #2534
Text: *press Enter twice to end*

The following is a closeup of the certification that we just entered:



9 Enlarge the two title lines ("Farmer Survey" and "Surveyor's Certification") by a factor of 2.0 using the command Text Enlarge/Reduce on the Edit menu, option Text. When prompted for Scaling Multiplier, enter 2. Select both the Farmer Survey text (at the top of the screen, not in the title block) and the Surveyor's Certification text. When asked again to Select Objects, press Enter.

When you are selecting objects, if you select something you don't want, you can enter "R" at the next Select Objects prompt, and remove items from the selection set. If you want to add objects

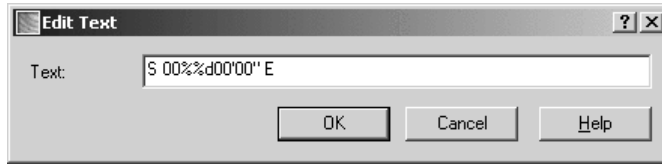
after you have removed an object, enter "A" at the next Select Objects prompt.

10 Make the enlarged Farmer Survey text at the top of the screen bold by changing its font to the bold font. Select the Text command from the Edit menu, Text, then select the Change Text Font option.

Select Objects: *pick the* Farmer Survey Text *at the top of the drawing*
Select Objects: *press Enter* for no more selections.
Style Name: Bold

11 Select the *Edit Text* command (under the Edit menu, Text option) to change

S 00°00'00" E to S 00° E. When you are prompted, "Select Text to Edit:" pick the due South bearing text. A dialog box appears as follows:



The degree symbol is represented as %%d. (If you had typed N 15%%d25'35" E in the Dtext command, Carlson would draw that entry as N15°25'35"E.) Click in the text to the immediate right of the quotation mark and press the Backspace key until the text reads as shown here.

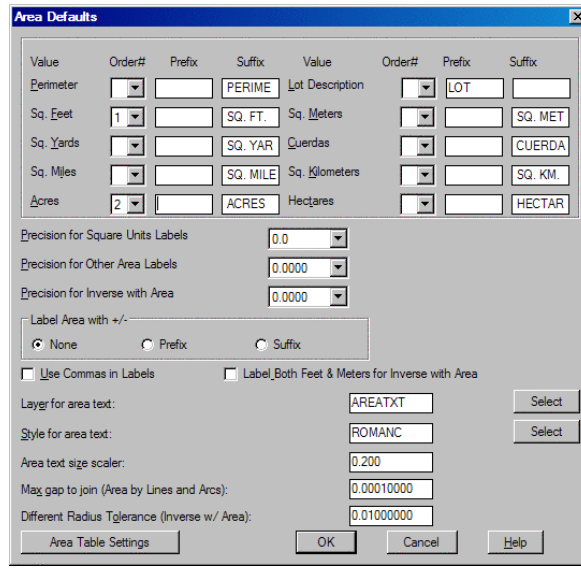
Click OK. Press Enter to exit the command.

12 In the enlargement in Step 8 showing the title block and also showing point 5, notice how the linework travels into the circle that represents the point. To clip off the linework at the edge of the corner symbols, use the *Trim by Point Symbol* command on the Points menu. This command requires that all points be in view, so if you cannot see your entire drawing, use the *Extents* command on the View menu (sometimes referred to as Zoom Extents). Respond to the following prompts:

Select point symbols to trim against. Select objects: ALL
Entering "all" at the command line selects everything on the screen. Only the linework crossing into the corner symbols will be trimmed.

Select objects: *press Enter*
You can continue to select objects until you press Enter.
The trimming is completed.

13 Prepare for area labeling by selecting the *Area Defaults* command on the Area menu. The dialog box shown below appears. Change the Other Area Labels and Inverse with Area decimal precision to 4 decimal places. Also, make the Area Text Size Scaler 0.2 (doubled from the default of 0.1).



You are going to compute the area by point number. You could have chosen the *Area by Lines & Arcs* command. In that command, you would pick the lines and arcs that make up the figure. But since the closure was 0.017 off (the distance from point 7 to point 1), you would exceed the default Max gap tolerance. Unless you change that tolerance in this dialog box to something larger than 0.017, you would get no result using the *Area by Lines & Arcs* command. So do not change it for this exercise because you might forget to change it back. Instead, you will compute the area by inversing from 1 through 7 and back to 1. Click OK to exit the *Area Defaults* dialog box.

14 Select *Inverse with Area* on the Area menu. Respond to the prompts as shown below:

Station/<Pick Starting point or point number>: 1

Pick point or point numbers (R-RadiusPt, U-Undo, Enter to end): 2
Pick point or point numbers (R-RadiusPt, U-Undo, Enter to end): 3
Pick point or point numbers (R-RadiusPt, U-Undo, Enter to end): R
Radius point number or pick point:CEN for center "snap"
Now move the cursor, without picking, to the arc and see how the center snap becomes active. When the radius point is found, pick on the arc.
Curve direction [Left/<Right>]?*press Enter* for the Right option
Pick End of Arc or point number (U-Undo, Enter to end): 4
Pick point or point numbers (R-RadiusPt, U-Undo, Enter to end): 5
Pick point or point numbers (R-RadiusPt, U-Undo, Enter to end): 6
Pick point or point numbers (R-RadiusPt, U-Undo, Enter to end): 7
Pick point or point numbers (R-RadiusPt, U-Undo, Enter to end): 1
Pick point or point numbers (R-RadiusPt, U-Undo, Enter to end): *press Enter* to end

A Standard Report Viewer dialog box showing the Inverse with Area results will appear. Select Exit at the top of the dialog box and respond to the prompts as shown below:

SQ. FEET: 83921.8 SQ. YARDS: 9324.6 SQ. MILES: 0.0
ACRES: 1.9266 PERIMETER: 1128.9671

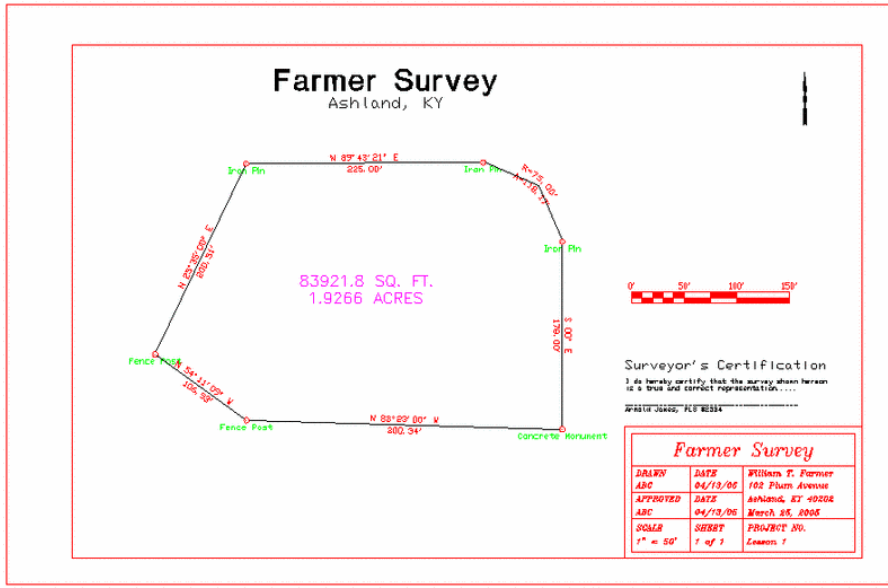
Pick area label centering point (Enter for none): *pick a point* near the center of the figure, in its interior. The area units you chose in *Area Defaults* are labeled on the screen.

Erase Polyline [<Yes>/No]: *Y*
This erases a polyline that has been drawn over the original lines and arcs. The *Inverse with Area* command draws this polyline because often you are solving the area from points and want the new linework drawn.

You snapped to the radius point using the "cen" snap. Additional object snaps appear under *Aperture-Object Snap* command on the Settings menu. Since all plotted points have a node, you could have inversed around this figure by using the "nod" snap for points 1 through 7, and the "cen" snap to capture the radius point. Snaps are typically entered at the keyboard as 3 characters (for example, "int" for intersect and "end" for endpoint).

15 Freeze the point numbers to finish the drawing by choosing *Layer Control* on the View menu. In the PNTNO row, click the sun icon to change it to a snowflake icon, which freezes the PNTNO layer. Click OK. The point numbers remain in the drawing, waiting to be "thawed", but they are not displayed.

The final drawing is shown here:

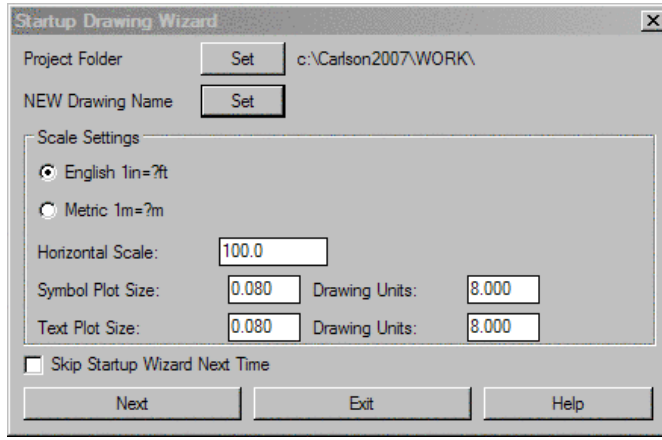


This completes the Lesson 1 tutorial: Entering a Deed.

Lesson 2: Making a Plat

In this lesson you will draw out a plat of a single lot, using Carlson drafting techniques. You will make the plat from an ASCII file of points named Plat.txt.

1 Click the icon for Carlson. You may be presented with a Startup Wizard dialog box, as shown below:

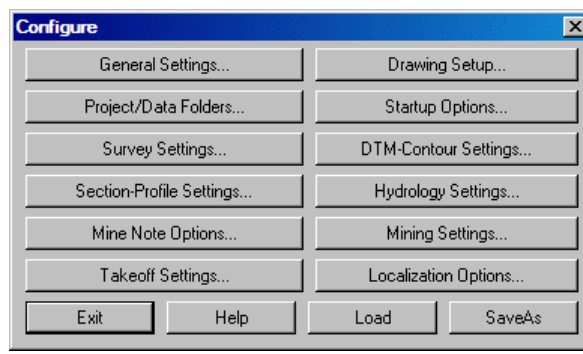


You will use the Wizard in Lesson 3 to quickly perform a series of commands. In this lesson, however, you will enter the commands individually, so that you can see what each one does.

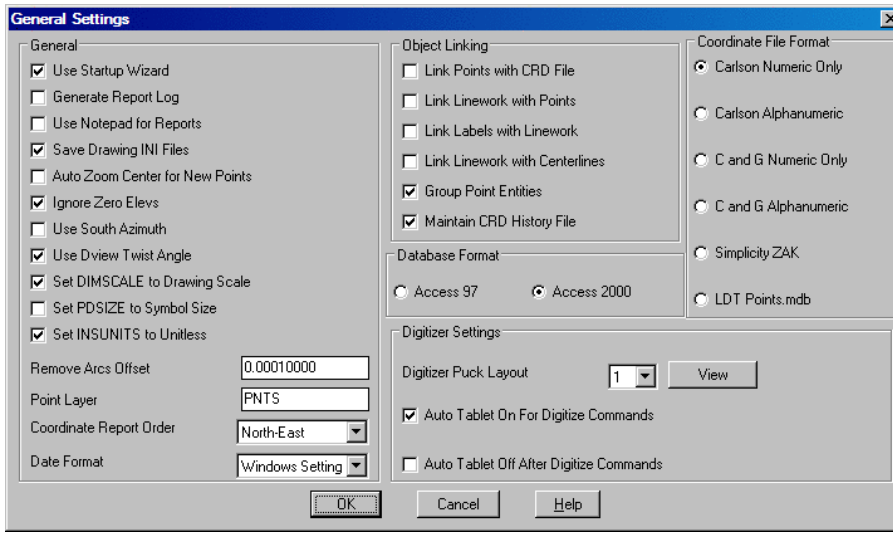
If you see the Startup Wizard dialog box, and you don't want to see it again, click the Skip Startup Wizard Next Time option in the dialog box above. Make sure the other settings are as shown above and click Exit.

Another way to turn off the Wizard is to click it off within the Configure > General Settings command, found under the Settings menu. You will open this General Settings dialog box now.

2 On the Settings menu, click Configure to display the following menu:



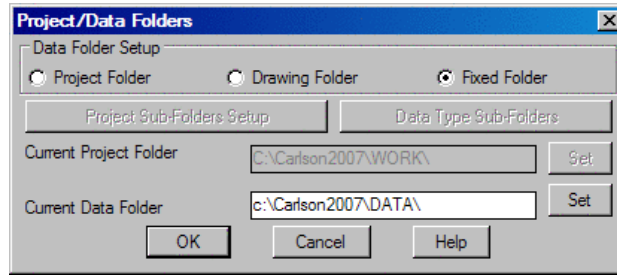
Click General Settings to display the dialog box shown here.



The settings in this dialog box, along with the settings in other Configure sub-options, determine default working conditions for Carlson. Turn on Group Point Entities, which groups point elevations, numbers, and descriptions (all aspects of the points) into a single entity for moving, erasing and other commands.

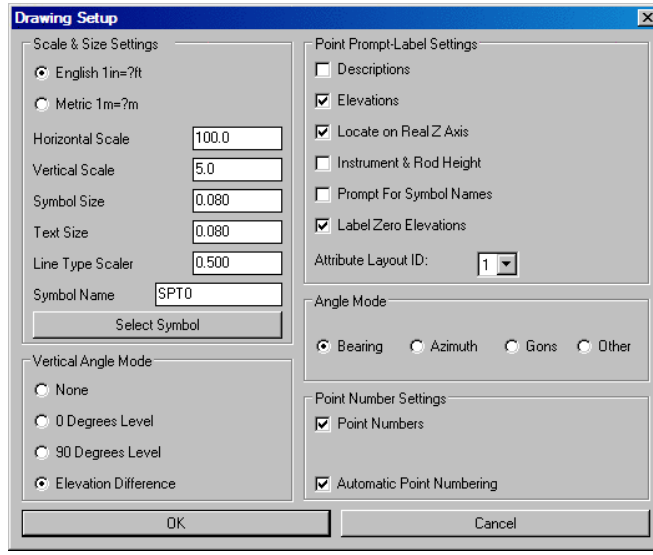
Choose Numeric Only to store points in numeric form. This produces point numbers such as 1, 2, 3, 10 and 11. If you selected Alphanumeric, then you could have point numbers like 1A, 1B, 1C, HUB5, CTRL, SS10, etc. There is a slight speed advantage to working with purely numeric point numbers. The highest numeric point number allowed is 32000. Regardless of format, point numbers are stored in a file that has a .crd extension. There is no limit to the number of points in an alphanumeric coordinate file. In anticipation of Lesson 3, click on the Use Startup Wizard option. Click OK at the bottom of this dialog box.

Now we want to set the data path. Another of the Configure sub-options is *Project/Data Folders*. Click this option and you will see this dialog box.



For this lesson, you will keep it simple. Click on Fixed Folder at the top. Notice the Current Data Folder section at the bottom. This specifies where data files, such as .crd files in this case, are to be stored. Set the folder to C:\Carlson2007\DATA. Click OK. You are now back to the Configure main dialog.

3 Select *Drawing Setup* from the Configure main dialog box.



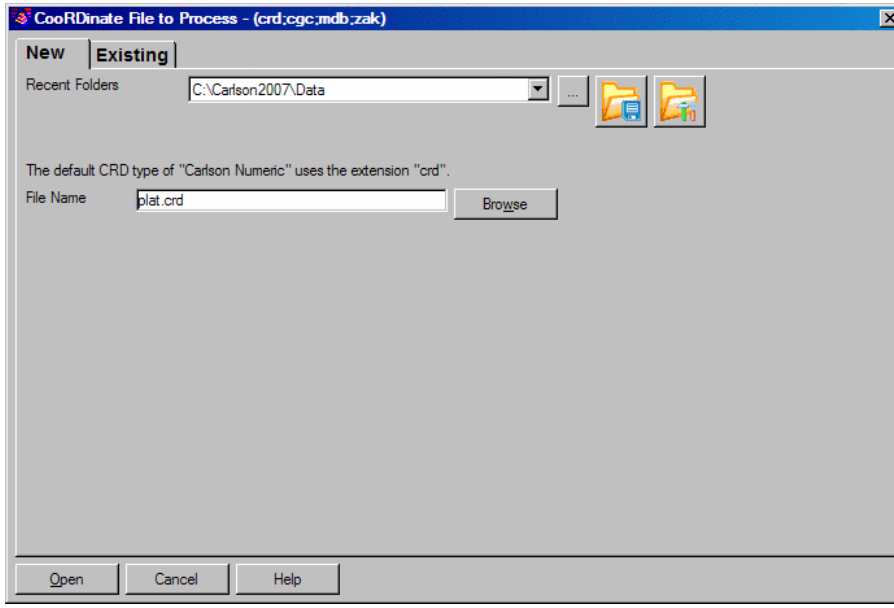
The scale acts as a multiplier on all text annotation. For example, 100 ∗ Text Plot Size (0.08) =

8 (text height of 8 units). The Text Plot Size is the effective height, in inches, that the text will appear when plotted at the Horizontal Scale (here 100).

Bearings and Distances, Legends, Title Blocks, and Point Symbols will size up or down on the basis of the Horizontal Scale set within *Drawing Setup*. Set the Horizontal Scale to 100. Then click OK to exit Drawing Setup. Then click Exit to close the Configure dialog box.

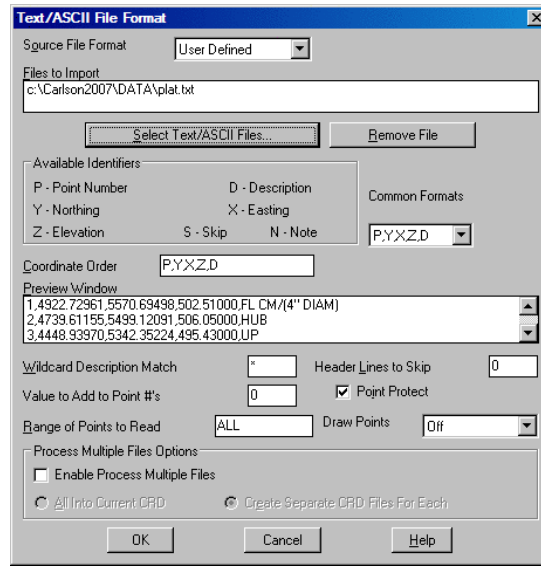
4 Next, you will import the ASCII file called Plat.txt and store the points in a Coordinate file called Plat.crd. However, since you are in a new drawing, you have not yet set a coordinate file to store the points in. You must have a Carlson coordinate file (.crd) open and established as the container for your points.

So, under the Points menu, select the command *Set CoorRDinate File* to display a dialog box. Click the New tab, as shown here. To the right of File name enter Plat and click Open. You have now created the required .crd file.



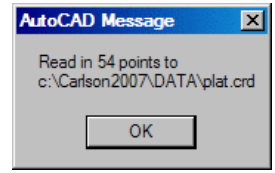
You are now ready to import the points. This time, under the Points menu, select *Import Text/ASCII File* to display the Text/ASCII File Format dialog box, as shown below. Click the

Select Text/ASCII Files button and then choose Plat.txt listed on the right. It is found in the default data folder (C:\Carlson2007\Data). Click Open.



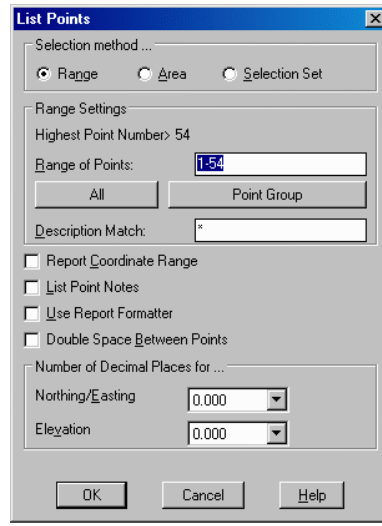
Plat.txt is an ASCII file containing 54 points in the form of Point Number, Northing, Easting, Elevation and Description. The format of the points appears in the Preview Window. The format is: Point (P), Northing (Y), Easting (X), Elevation (Z), Description (D), or, in short, P,Y,X,Z,D. You must match this format in the Coordinate Order. If you don't see P,Y,X,Z,D in the Coordinate Order box, then select that format from the Common Formats option. Or, you can type the list directly into the Coordinate Order box. Make sure that Draw Points is set to Off.

Click OK. The points will be saved and stored in Plat.crd. A confirming dialog appears as follows:

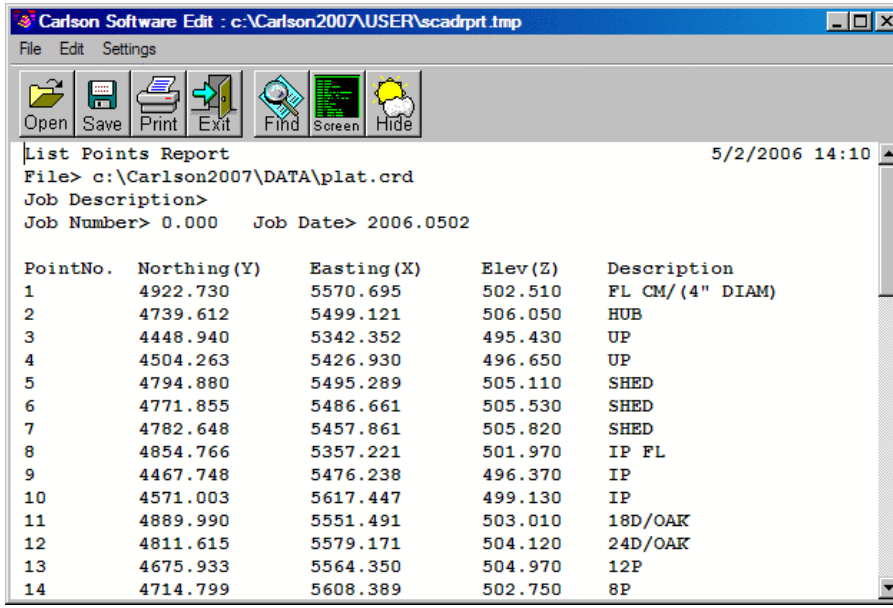


Click OK.

5 Choose the *List Points* command under the Points menu.

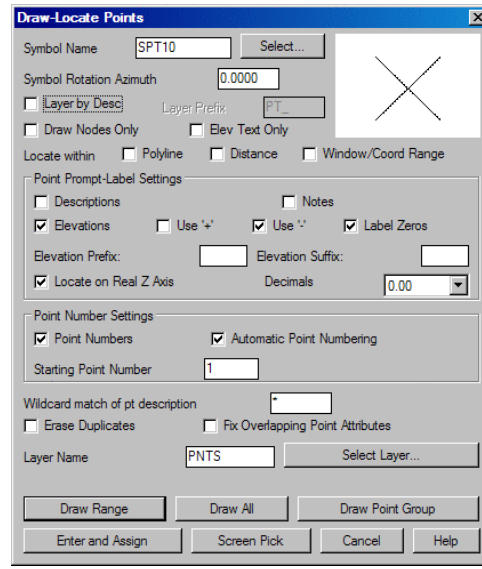


The *List Points* dialog box will typically default to the full range of points, which is 1 through 54 in this exercise. You can control the decimal places for the Northing/Easting and the Elevation of the points in the lower portion of the dialog box. Click OK and the settings shown above result in the report exhibited below in the Standard Report Viewer:



Exit the report by selecting the Exit icon at the top of this report viewer box, or by clicking the X in the upper right of the window.

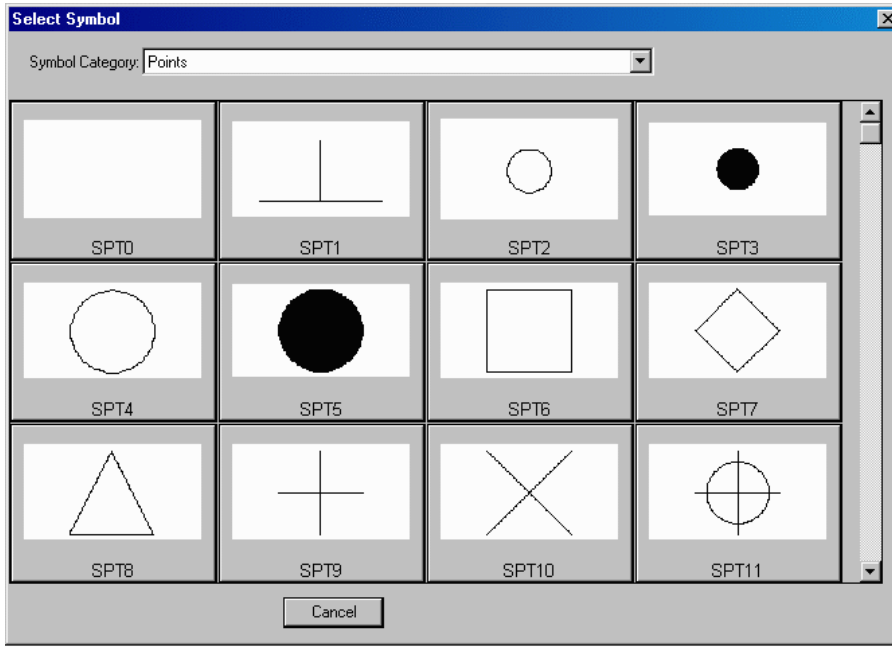
6 Select the *Draw-Locate Points* command on the Points menu to draw the points on the screen.



In this figure shown above, the current Symbol Name is showing as SPT10, which stands for Survey Point symbol 10. SPT10 is an X, shown in the symbol display window. You can select a different default symbol using the *Point Defaults* command on the Points menu.

In this exercise you will change the Symbol Name to null, or symbol 0, listed as SPT0 (in effect, no symbol). Later, you will add official property corner and utility symbols. Although you are working without a default symbol, there will always be a "dot" or a node at the correct insertion point of each point number.

At the top click Select. You will see the following dialog box:

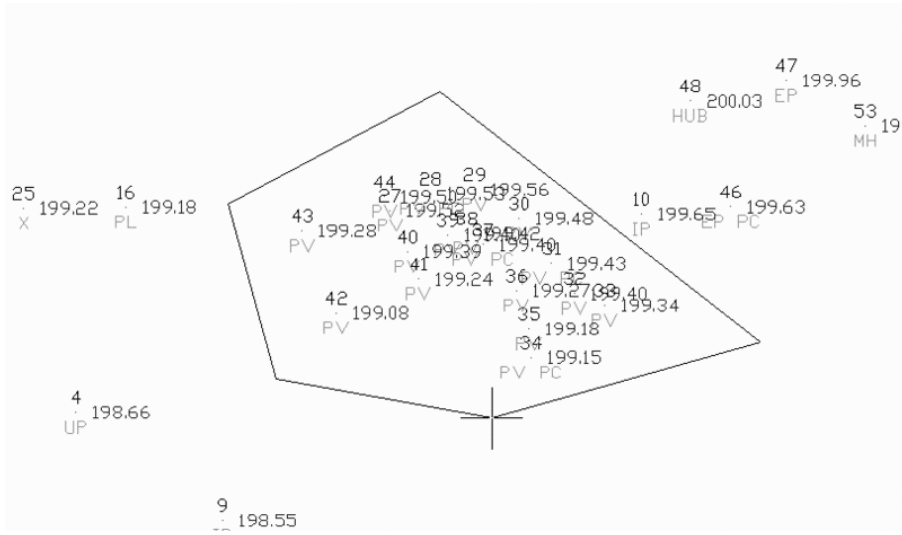


Note that the scroll bar at the right of this Select Symbol dialog box leads to more pages of symbols. Click the blank SPT0 point symbol option.

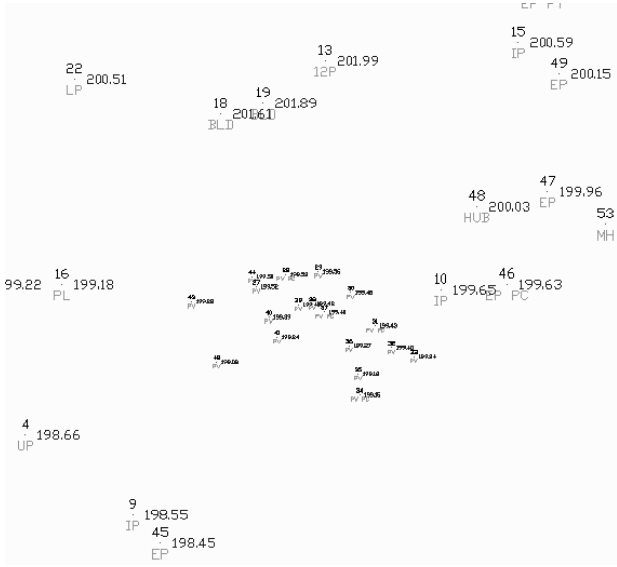
When you select a symbol, you automatically return to the Draw-Locate Point dialog box. Click Draw All to display the rather busy drawing shown below:

7 You will now be using the *Scale Point Attributes* command on the Points menu. Notice how the lower-right corner of the drawing is very congested, with many point attributes overlapping. You can specify a window containing these points and scale them down by a factor of 0.4. For Scaling Multiplier, you will enter 0.4. When you are prompted to Select Carlson Software points, you will enter WP for Window Polygon and make a polygon around the congested area. Press Enter when you have surrounded the points with the polygon as shown below. Here is the command line sequence, along with the responses you will enter, after clicking *Scale Point Attributes*:

Scaling Multiplier <0.500>: .4
Scale symbols only, point labels only or both [Symbols/Labels/<Both>]? *press Enter*
Select points from screen, group or by point number [<Screen>/Group/Number]? *press Enter*
Select Carlson Software points.
Select objects: wp
First polygon point: *start creating your polygon*

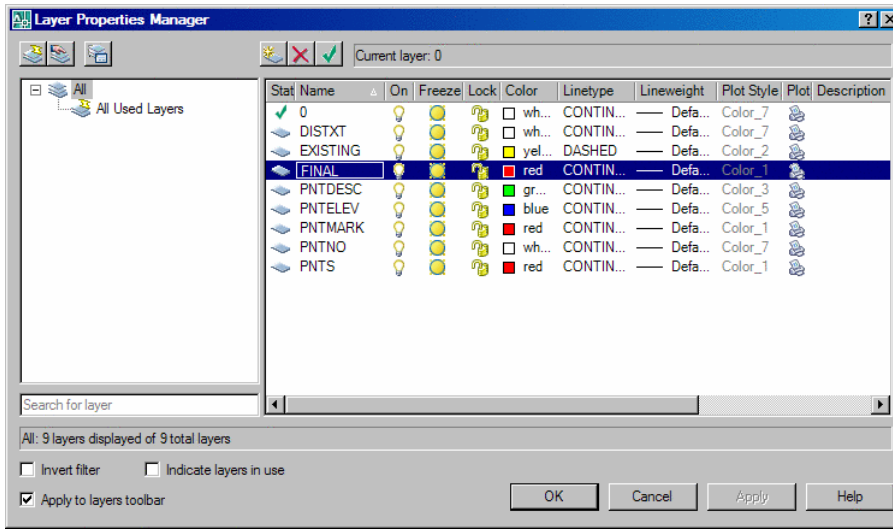


Once this polygon is complete, you are again prompted to select points. Press Enter. The following shows the scaled points.



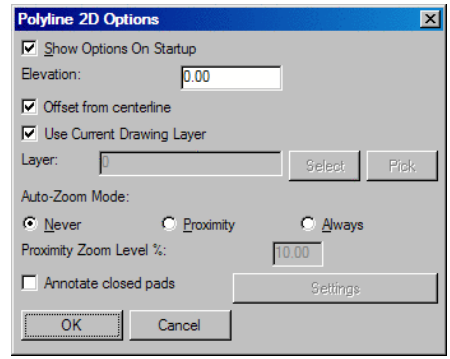
8 Next, you will prepare for drawing linework by setting the current layer. You should draft linework and symbol work in designated layers. In this example, you will put linework and

symbol work in a layer named Final. (You could put property linework in the Final layer and utility linework in the Utility layer, but, for now, you will put all linework and symbols in the layer Final.) To pick the current working layer, select the Layer Control command from the View menu.


Layer Properties Manager
Current layer: 0
All
All Used Layers
Stat Name On Freeze Lock Color Linetype Lineweight Plot Style Plot Description
0 wh... CONTIN... Defa... Color_7
DISTXT wh... CONTIN... Defa... Color_7
EXISTING yel... DASHED Defa... Color_2
FINAL red CONTIN... Defa... Color_1
PNTDESC gr... CONTIN... Defa... Color_3
PNTELEV blue CONTIN... Defa... Color_5
PNTMARK red CONTIN... Defa... Color_1
PNTNO wh... CONTIN... Defa... Color_7
PNTS red CONTIN... Defa... Color_1
Search for layer
All: 9 layers displayed of 9 total layers
Invert filter
Indicate layers in use
Apply to layers toolbar
OK
Cancel
Apply
Help

Click Final. Click Current. Click OK.

9 The *2D Polyline* command allows you to enter point numbers to draw a line. First, connect portions of the property line. Select the *2D Polyline* command on the Draw menu. A dialog box might appear. If it does, accept the defaults and click OK.



[Continue/Extend/Follow/Offset/OPtions/<Pick point or point numbers>]: 1
[Arc/Close/Distance/Follow/Offset/Undo<Pick point or point numbers>]: 8
[Arc/Close/Distance/Extend/Follow/Line/Offset/Undo<Pick point or point numbers>]: *press Enter*

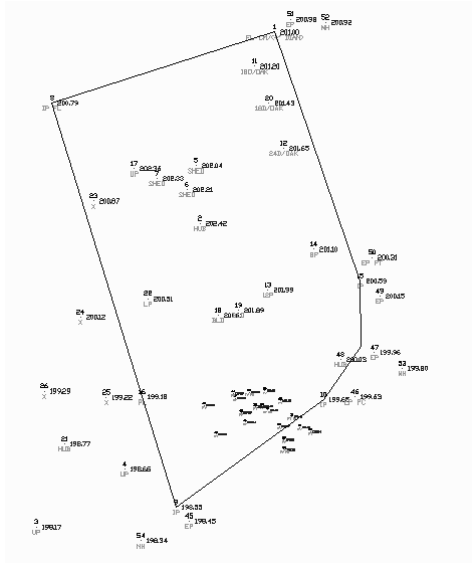
This creates a polyline. Keep this as a separate polyline because later you will turn this back lot line into a fence line.

Now, connect some of the other property lines. Repeat the 2D Polyline command. You can press Enter to repeat the command, or you can select it from the Draw menu. Connect points 8 through 10, and start an arc, by entering as follows:

[Continue/Extend/Follow/Offset/OPtions/<Pick point or point numbers>]: 8-10
[Arc/Close/Distance/Extend/Follow/Line/Offset/Undo<Pick point or point numbers>]: a
[Radius pt/radius Length/Arc length/Chord/Second pt/Undo/<Endpoint or point number>]: 15
[Arc/Close/Distance/Extend/Follow/Line/Offset/Undo<Pick point or point numbers>]: 1
[Arc/Close/Distance/Extend/Follow/Line/Offset/Undo<Pick point or point numbers>]: *press Enter* to end the command

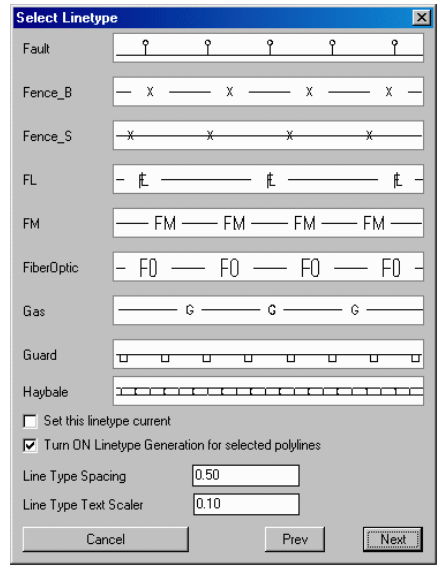
This creates the full lot, with the arc coming off point 10 on a tangent. The line from 15 to 1 is not guaranteed to be tangent to the previous arc.

You should have the following linework at this point:



10 You will now create a fence line on the polyline you drew from points 1 to 8. Go back to Drawing Setup from the Settings menu and set the Horizontal Scale to 50. Click OK to exit Drawing Setup.

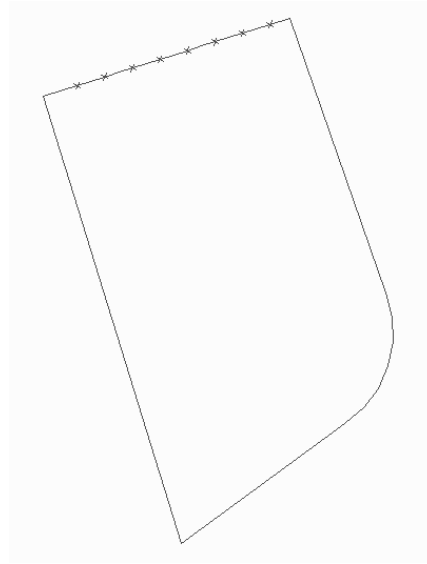
Now, choose the Line Types command on the Annotate menu and select the Change Polyline Linetype command. The Line Types command creates polylines that respond as one entity when selected. When tlhe dialog box appears, click Next twice to display the dialog box shown below.



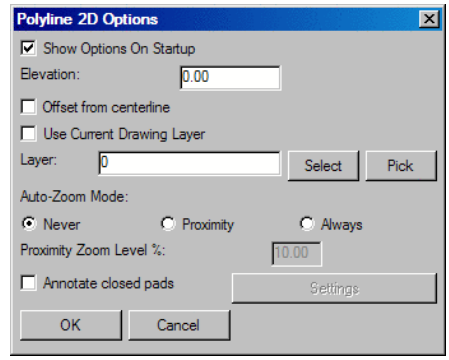
Choose the Fence_S option (the solid fence line).

When prompted to Select Objects, pick the polyline you created from points 1 to 8. Press Enter to end selection. Notice in the dialog box above that the current Line Type Scaler, governing spacing, should be 0.5 (inches) and the Text (height) Scaler is 0.1. If your settings are different, you may want to Undo (by entering U for undo) the fence line and select the *Annotate Defaults* command on the Annotate menu, and set these items to match the example.

On the View menu, select the *Isolate Layers* command, pick the property line, and press Enter twice. Here is the result:



11 Next, you will connect up the edge of pavement. On the View menu, select the *Restore Layers* command to restore your points. Then select the *2D Polyline* command under the Draw menu. Again, a dialog box might appear as shown below. If it does, make sure that the options selected are the same. In the future you can choose not to see this box.



Click OK. Proceed as follows to connect up the edge of pavement:

[Continue/Extend/Follow/Options/<Pick point or point numbers>]:45-47,49-51
Press Enter at the next prompt to exit the command and create the road. Press Enter one more

time. Note how you can separate range entries using a comma.

12 To smooth the edge of the road, select the *Polyline Utilities* command on the Edit menu, and select *Smooth Polylines*.

Enter the looping factor (1-10) <5>: *press Enter*
Enter the offset cutoff <0.05>: *press Enter*
Select objects: *pick the edge of road polyline*
Select objects: *press Enter*

13 To offset the smoothed edge-of-road polyline by 24 feet to make the opposite edge of the road, Select the *Standard Offset* command on the Edit menu.

Specify offset distance or [Through/Erase/Layer] <Through>: 24
Select object to offset or [Exit/Undo] <Exit>: *pick the edge-of-road polyline*
Specify point on side to offset or [Exit/Multiple/Undo] <Exit>: *pick to the right of the polyline*
Select object to offset or [Exit/Undo] <Exit>: *press Enter* to end the command

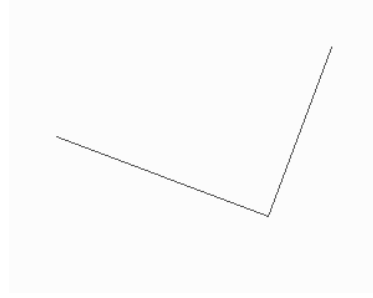
Now, select the *Isolate Layers* command again from the View menu, pick on any of your linework, and only the entities on the picked layers are displayed.

Select the *Restore Layers* command from the View menu to recover your points. Experiment with the "cadence" of Isolate and Restore Layers. Select Isolate Layers, pick the layers to isolate, then press Enter twice. Then select Restore Layers.

14 Next, you will draw the shed. Select the 2D Polyline command on the Draw menu. To draw a two-sided shed, connect points 5 through 7 as follows:

[Continue/Extend/Follow/Options/<Pick point or point numbers>]: 5-7, *press Enter twice*

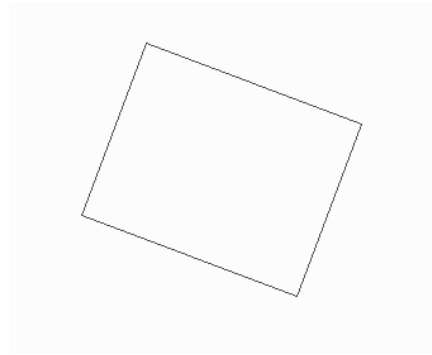
This produces the 2-sided building shown here:



Select the *4 Sided Building* command on the Survey menu. Turn the 2-sided shed into a 4-sided shed as follows:

Options/<Pick a line or polyline>: *Pick the shed*

Now your 2-sided building looks like this:



15 Focus your attention on the area of tightly spaced points with point numbers ranging from 27 to 44. This is the driveway and paving area. In the case of the driveway, assume that the surveyor who collected the points shot in 3-point arcs. They came up to a PC, shot a point on the arc, and finished up at the PT.

On the View menu, select the *Window* option, and pick a lower left and upper right point that windows the driveway area. (If you wish to use the View>Previous command to zoom out, then use View>Window to zoom in again.)

Select the 2D Polyline command under the Draw menu, and walk the polyline through the two arcs as follows:

[Continue/Extend/Follow/Options/<Pick point or point numbers>]: 27
[Arc/Close/Distance/Follow/Undo/<Pick point or point numbers>]: 28
[Arc/Close/Distance/Extend/Follow/Line/Undo/<Pick point or point numbers>]: A
[Radius pt/radius Length/Arc length/Chord/Second pt/Undo/<Endpoint or point number>]: S
Use S for 3-pt arcs.

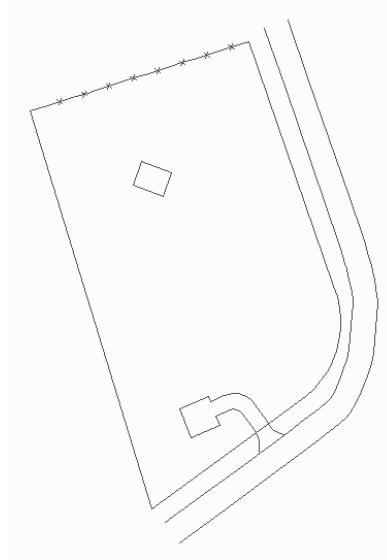
Second point or point number: 29
Endpoint or point number: 30
[Arc/Close/Distance/Extend/Follow/Line/Undo/<Pick point or point numbers>]: 31
[Arc/Close/Distance/Extend/Follow/Line/Undo/<Pick point or point numbers>]: A
[Radius pt/radius Length/Arc length/Chord/Second pt/Undo/<Endpoint or point number>]: S
Second point or point number: 32
Endpoint or point number: 33
[Arc/Close/Distance/Extend/Follow/Line/Undo/<Pick point or point numbers>]: *press Enter*

In the above exercise you started at point 27, went to the PC at point 28 and inserted a 3-point arc through points 29 and 30. You proceeded tangent to point 31, which was another PC, then completed a 3-point arc through points 32 and 33, and ended.

Now, connect up the basketball court area. Select the *2D Polyline* command under Draw, or press Enter to repeat the previous command.

[Continue/Extend/Follow/Options/<Pick point or point numbers>]: 27
[Arc/Close/Distance/Follow/Undo/<Pick point or point numbers>]: 44
[Arc/Close/Distance/Extend/Follow/Line/Undo/<Pick point or point numbers>]: 43-39 (you can enter "backwards" ranges)
[Arc/Close/Distance/Extend/Follow/Line/Undo/<Pick point or point numbers>]: A
[Radius pt/radius Length/Arc length/Chord/Second pt/Undo/<Endpoint or point number>]: S
Second point or point number: 38
Endpoint or point number: 37
[Arc/Close/Distance/Extend/Follow/Line/Undo/<Pick point or point numbers>]: 36
[Arc/Close/Distance/Extend/Follow/Line/Undo/<Pick point or point numbers>]: A
[Radius pt/radius Length/Arc length/Chord/Second pt/Undo/<Endpoint or point number>]: S
Second point or point number: 35
Endpoint or point number: 34
[Arc/Close/Distance/Extend/Follow/Line/Undo/<Pick point or point numbers>]: *press Enter*

Shown below is your drawing to this point.



16 Next you will make a building footprint. Points 18 and 19 are two shot corners of a building. Assume that the surveyors taped the main house, going clockwise from point 18, as follows: 10'L, 20'R, 40'L, 20'R, 20'L, 83'L, 60'L, 23'L, 10'R.

You can easily enter these "jogs" in the building using the Extend by Distance command. If you are zoomed in on the driveway, use View > Zoom > Zoom Out, then View > Pan to focus on the building north of the driveway. Now use the 2D Polyline command on the Draw menu to draw a line from 18 to 19.

Pick point or point numbers:18
Undo/Arc/Length/<Pick point of point numbers>:19, *then press Enter twice* to end

Select the *By Distance* option from the Edit menu, *Extend* command.

Pick line or pline to extend: *pick the building line closer to point 18*

This makes the arrow point toward 18 rather than 19. Now you can go clockwise:

Enter or pick distance to Draw (A,B,C,E,I,L,M,N,O,P,R,S,T,U,Z,?,Help): L10 *(lower case "l" and "r" work also)*
Enter or pick distance to Draw (A,B,C,E,I,L,M,N,O,P,R,S,T,U,Z,?,Help): R20
Enter or pick distance to Draw (A,B,C,E,I,L,M,N,O,P,R,S,T,U,Z,?,Help): L40
Enter or pick distance to Draw (A,B,C,E,I,L,M,N,O,P,R,S,T,U,Z,?,Help): R20

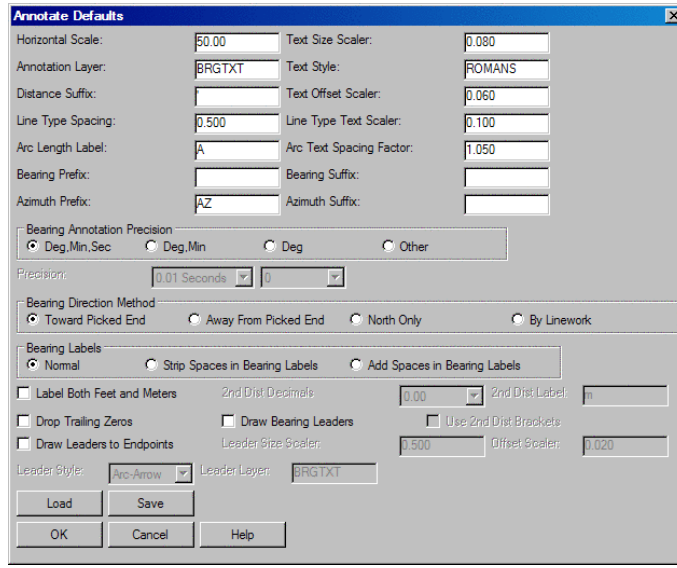
Enter or pick distance to Draw (A,B,C,E,I,L,M,N,O,P,R,S,T,U,Z,?,Help): L20
Enter or pick distance to Draw (A,B,C,E,I,L,M,N,O,P,R,S,T,U,Z,?,Help): L83
Enter or pick distance to Draw (A,B,C,E,I,L,M,N,O,P,R,S,T,U,Z,?,Help): L60
Enter or pick distance to Draw (A,B,C,E,I,L,M,N,O,P,R,S,T,U,Z,?,Help): L23
Enter or pick distance to Draw (A,B,C,E,I,L,M,N,O,P,R,S,T,U,Z,?,Help): R10
Enter or pick distance to Draw (A,B,C,E,I,L,M,N,O,P,R,S,T,U,Z,?,Help): *press Enter* to end

17 Next, you will complete the linework for the sewer line and the electric utility line. Use the View > Extents command so you can see all your points.

The sewer line runs from points 52 to 53 to 54. Select the *2D Polyline* command from the Draw menu. To create the sewer line, enter the following:

[Continue/Extend/Follow/Options/<Pick point or point numbers>]: 52-54, *press Enter twice* to end

You will next annotate the sewer polyline using the Change Polyline Linetype command, but first you must set the default spacing for the annotation. Select the *Annotate Defaults* command on the Annotate menu. The following dialog box appears.



Change the Line Type Spacing to 1.5. This will label "S" on the sewer line every 1.5" at the current scale (1"=50').

To annotate the sewer line with an S, select the *Line Types* command on the Annotate menu, then choose *Change Polyline Linetype*. Within the dialog box, click Next four times, select the Sewer linetype from the list, and then select the sewer polyline that runs next to the road. The polyline will be annotated.

Next, create the electric utility line, which runs from point 3 to point 4 to point 17. Select the *2D Polyline* command on the Draw menu.

[Continue/Extend/Follow/Options/<Pick point or point numbers>]: 3
[Arc/Close/Distance/Follow/Undo/<Pick point or point numbers>]: 4
[Arc/Close/Distance/Extend/Follow/Line/Undo/<Pick point or point numbers>]: 17
[Arc/Close/Distance/Extend/Follow/Line/Undo/<Pick point or point numbers>]: *press Enter twice* to end

No points were taken beyond point 17, due to obstructions from the various setups in the field. So you must extend the polyline from point 17 to beyond the property. Under the Edit menu, choose *Extend*, then *By Distance*. Pick on the electric utility polyline near point 17. Then pick beyond the property. Press Enter to end.

Before you annotate the electric utility line, you must offset it 25' on both sides, for a 50' total right-of-way. You will do this using *Standard Offset*. Select the *Offset>Standard Offset* command under the Edit menu. Enter the offset distance of 25. Pick the electric utility polyline and then pick to one side for the first offset. Repeat for the other side, by first picking the electric utility polyline, then picking the other side for the offset. Press Enter to end.

Now annotate the central electric line with an E by selecting the *Line Types* command on the Annotate menu, then choose *Change Polyline Linetype*. Choose the Electric linetype, which appears on the second page of linetypes. Then select the electric utility polyline to annotate it, and press Enter.

18 Next, make the Property lines bold. Under the Edit menu, select *Polyline Utilities*, then *Edit Polyline* and then select *Change Polyline Width*.

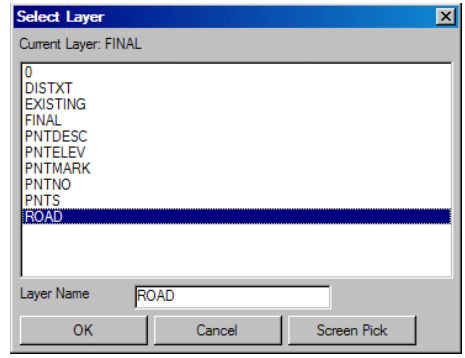
New Width <0.0>: 1.5
Select objects: *pick the property polylines while holding down the Shift key* Pick once for the fence line portion and once for the remaining property lines.
Select objects: *press Enter* to end

19 To add color and improve layer management, make a layer for your road and driveway. Select the*Layer Control* command on the View menu.

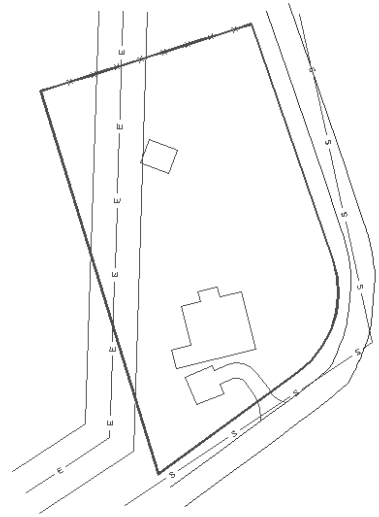
Click the New Layer button, and enter the name "Road" for the new layer. Choose the color cyan by clicking the color square to the right of the layer name. Click OK.

On the View menu, select the *Change Layer* command.
Select entities to be changed.
Select objects: *with Shift key held down, pick all driveway and road entities and press Enter*

This brings up the dialog box shown below. Select ROAD and click OK.



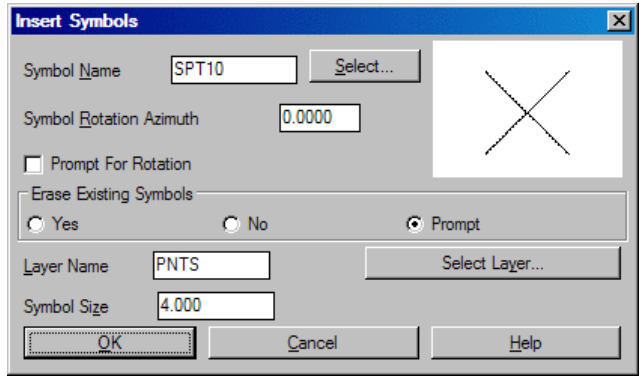
Your linework is now complete and is shown below:



If you have not already saved your drawing, now is a good time to do it. Use the Save command on the File menu, and call the file Lesson2.dwg.

20 You will add symbols for trees, property corners, manholes and a light pole.

Start with the trees. Points 11, 12, and 20 are oak trees of different sizes, and point 14 is a pine tree. Use symbol 61 for the deciduous oak trees and symbol 53 for the pine tree. On the Draw menu select Symbols. Then select the *Insert Symbols* command. The following dialog box appears.



Click the Select button, and within the Select Symbol dialog box, use the down arrow at the right to scroll forward to the tree symbols, which are several pages deep. Choose symbol SPT61. You can also choose Trees under the Symbol category field in this dialog. You are returned to the Insert Symbols dialog box.

Click the Select Layer button, and type in TREES in the Layer Name field. This creates a Trees layer if one does not exist. Click OK. For the Symbol Size use 18. A symbol size equal to the diameter of the tree is often effective. Click OK.

Options/Select entities/Enter Coords/<Pick point or point numbers>: 11
Options/Select entities/Enter Coords/<Pick point or point numbers>: 20
Options/Select entities/Enter Coords/<Pick point or point numbers>: *press Enter*

Place symbol 61 on the larger point 12 at size 24. Press Enter to repeat the last command, or

once again select the *Insert Symbols* command from the Draw menu. Symbol 61 will now be the default. Change the Symbol Size to 24 and click OK.

Options/Select entities/Enter Coords/<Pick point or point numbers>: 12
Options/Select entities/Enter Coords/<Pick point or point numbers>: *press Enter*

Place symbol 53 on the larger point 14 at size 8. To do this, press Enter to repeat the last command, or select *Insert Symbols* from the Draw menu. Select symbol 53 and a Symbol Size of 8. Click OK.

Options/Select entities/Enter Coords/<Pick point or point numbers>: 14
Options/Select entities/Enter Coords/<Pick point or point numbers>: *press Enter*

Place symbol 5 (representing an iron pin) on points 8-10 and point 15. Repeat *Insert Symbols* by pressing Enter to repeat the last command, or again select the *Insert Symbols* command from the Draw menu. Select symbol 5 (first page) and leave the Symbol Size of 8. Change the layer to FINAL. Click OK.

Options/Select entities/Enter Coords/<Pick point or point numbers>: 8-10,15
Wildcard match of point description <*>: *press Enter*
This puts symbols on points 8 through 10, as well as point 15.
Options/Select entities/Enter Coords/<Pick point or point numbers>: *press Enter*

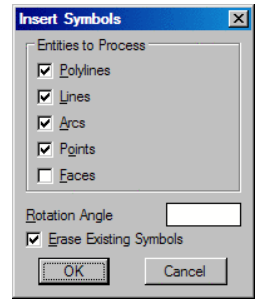
Place a concrete monument (symbol 13) on point 13 on layer FINAL. Keep the Symbol Size of 8. Press Enter to repeat the last command, or select the *Insert Symbols* command from the Draw menu. Select symbol 13.

Options/Select entities/Enter Coords/<Pick point or point numbers>: 13
Options/Select entities/Enter Coords/<Pick point or point numbers>: *press Enter*

Place a manhole (symbol 34) on the vertices (endpoints) of the sewer line, at points 52 through 54. You could use the above method, but you can also use S for Select entities, and place the symbol automatically at the vertices of the selected entity.

Select the *Insert Symbols* command from the Draw menu. Select symbol 34 from the list. Keep with layer FINAL and Symbol Size 8. Click OK.

Options/Select entities/Enter Coords/<Pick point of point numbers>: S
The following dialog box appears. Click OK.

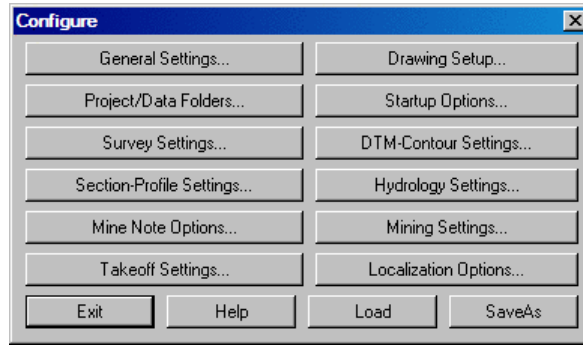


Select arcs, circles, faces, points, text, lines and polylines.
Select objects: *pick the sewer polyline*

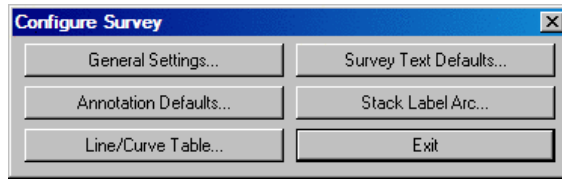
The symbols are inserted at the three polyline endpoints.

21 You can reduce clutter by selecting the *Freeze Layer* command under the View menu, and picking a point number. The points freeze, leaving only linework and symbols. To bring the points back, use the *Thaw Layer* command under the View menu. The *Freeze Layer* and *Thaw Layer* commands go together, just like the Isolate and Restore Layers commands.

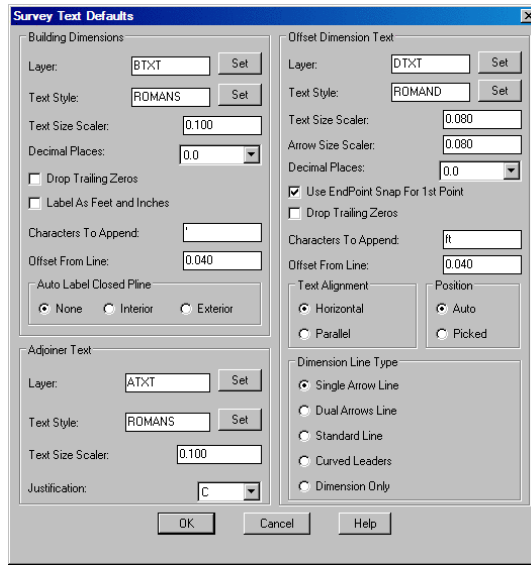
22 Next, you will create (in reduced size) your building dimensions. You can set the building dimension text size for the current work session using the *Survey Text Defaults* option of the Survey Text command on the Annotate menu. However, you can set the text size permanently using the *Configure* command on the Settings menu, then selecting the *Configure* command. Use this last method. This dialog box appears:



Select *Survey Settings* and the following dialog box appears:



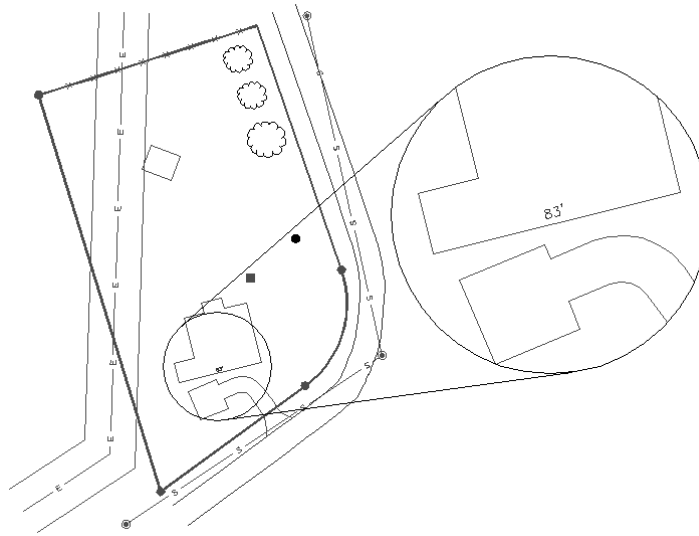
Choose *Survey Text Defaults*. The following dialog box appears:



The changes you will make are in the upper-left section "Building Dimensions." Change the Text Size Scaler to 0.04, change Offset From Line to 0.02, and select Drop Trailing Zeros.

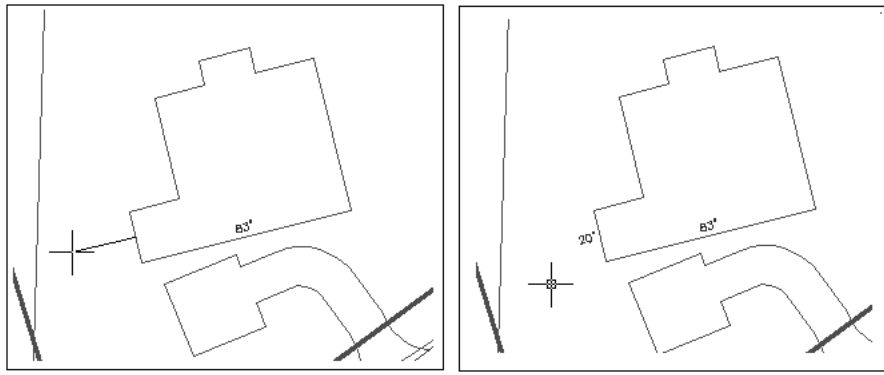
The Drop Trailing Zeros option will label 17.0' as 17'. To save more space, you could blank the Characters to Append box, but not this time. Enter the name of a new layer for the building text called BTXT, so that building dimensions can be frozen to reduce the clutter even more. It is generally a good strategy to use layers for selective freezing and thawing.

Click OK on the above dialog box, then click Exit until you return to the command prompt. On the Annotate menu, choose the *Survey Text* command, *Building Dimensions* option. Click on the middle of the bottom segment of the building and then drag the alignment to the right, along the same bottom segment being dimensioned. The resulting label is shown below.

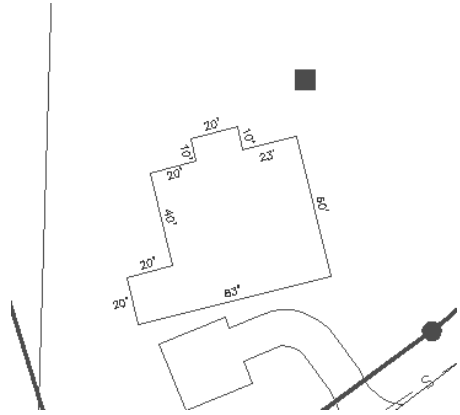


If you had dragged the cursor to the left rather than to the right, with the same near-parallel angle to the line, the 83' would be drawn below the building rather than above.

Another example is shown below. Select Annotate > Survey Text > *Building Dimensions,* and click on the left-most segment of the building. Then click roughly perpendicular to the left. This creates a perpendicular, rather than parallel, label as shown below.



Label the rest of the building. Notice that the sides of the building that you are dimensioning are measured in even feet. Because you had selected the Drop Trailing Zeros option when you set your Survey Text Defaults, and you set the Decimal Places default at 0.0, the ".0" is not reflected in the labels,



If you choose the wrong direction while you are labeling, you can exit the command, or you can erase the incorrect dimension by typing E for erase at the command line, or you can enter U for undo to back out your last work. Once the labels are in place, you can type M for the Move command, and move the text to the desired position.

23 Next, you will label the offset dimension from property lines to two building corners, the SE corner as offset from the south property line, and the SW corner as offset from the west property line. Because of the options you set in the Survey Text Defaults dialog box above, Offset Dimensions will be created on layer DTXT, and they will be horizontal, with arrowheads.

On the Annotate menu select Survey Text, Survey Text Defaults. The dialog previously shown will reappear. Change the Text Size and Arrow Size Scalers to 0.040. Then select Dual Arrows Line and click OK. On the Annotate menu, select Survey Text, Offset Dimensions option.

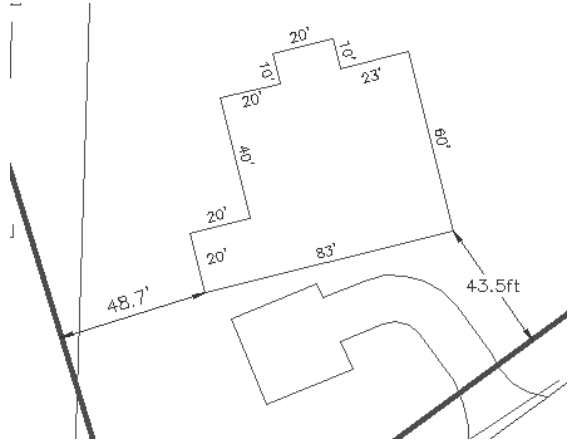
[end on] Pick Bldg/Object Corner: *pick on the SE building corner*
[perp] Pick Line To Offset From: *pick on the South property line* (before the arc, near the end of the driveway)

The setback is labeled 43.5 ft. Why "ft" and not " ' " for distance? If you review the Survey Text Defaults dialog box again, you will see that you set the Characters to Append option to "ft".

On the Annotate menu, select Survey Text > Survey Text Defaults. Under Offset Dimension Text, change the characters to Append to an apostrophe, " ' ". Also, change the Text Alignment to Parallel instead of Horizontal. Click OK. Select Annotate > Survey Text > Offset Dimensions.

[end on] Pick Bldg/Object Corner: *pick on the SW building corner*
[perp] Pick Line To Offset From: *pick on the West property line* (avoid the electric right-of-way line)

Use the Move command to move the 20' text label to the right, so that it is not overwritten by the offset dimension. The result is shown below:



Notice the display, within the above prompts, of the [end on] and [perp] snaps. When Carlson sets a snap for temporary use, it displays the snap within the brackets as shown. A building corner is always an endpoint, so the end snap always applies to the first pick. The offset is the perpendicular distance to the property lines, so the [perp] snap always applies to the second pick. The per, or perpendicular, snap applies to offsets from arcs as well. In the case of arcs, the per

snap finds the shortest, radial distance to the arc.

When you enter a snap at the keyboard in response to a "Pick object" request, type only the first 3 letters of the snap, such as "per" or "end". You could use the Offset Dimension command to label the Electric utility right-of-way distance of 50' total by entering "nea" (for nearest snap) for the first pick, then entering the default "per" snap for the second pick on the other side of the right-of-way.

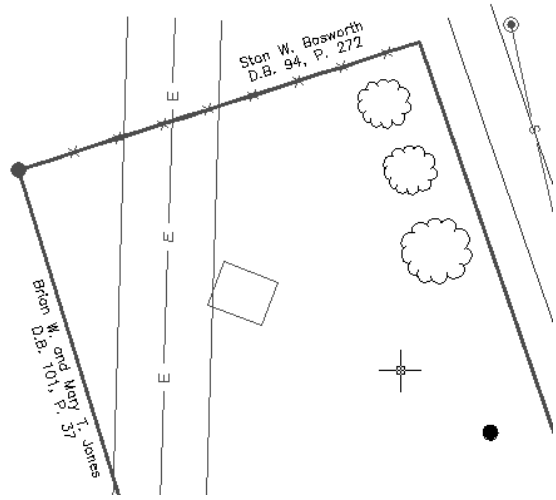
24 Next, you will add adjoiner ownership text to the property lines. Select the *Survey Text Defaults* command, under the Annotate menu, and set the Adjoiner Text Justification option to C for centered, and the Text Size Scaler to 0.06. Click OK and then select the *Adjoiner Text* option on the Annotate > Survey Text command.

Pick Line Or Polyline: *pick the west property line*
Pick Starting Point: *pick a centering point west of the property for the adjoiner text*
Text: Brian W. and Mary T. Jones
Text: D.B. 101, P. 37
Text: *press Enter twice*

This produces parallel, center-justified text on the west side of the property. Repeat the command for the north side. Press Enter to repeat the Adjoiner Text command or select it from the menus.

Pick Line Or Polyline: *pick the north property line*
Pick Starting Point: *pick a centering point north of the north property line*
Text: Stan W. Bosworth
Text: D.B. 94, P. 272
Text: *press Enter twice*

The results are shown here:



25 Next, you will add bearing annotation. Select the Annotate menu, choose Angle/Distance, select the BearingDistance_ option to place Bearing and Distance above the line.

Define bearing by, Points/<select line or polyline>: *pick the northern property line to the east, or right side* The bearing direction will be labeled towards the picked end, which is northeast.
Define bearing by, Points/<select line or polyline>:pick the eastern property line Pick closest to the southern endpoint of the line

To label the western property line on the lower (western) side of the line, select the _BearingDistance option of the Angle/Distance command.

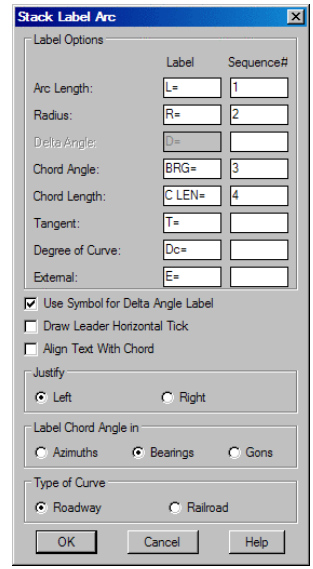
Define bearing by, Points/<select line or polyline>: *pick the western property line* on the northern portion of the line

To label the southern line segment with a leader, on the Annotate menu select the Annotate w/Leader command, *Brg-Dist w/Leader* option.

Options/Points/<Select line or polyline>: *pick the southern property line segment* on the southwest side
Pick point to start leader: *pick a point* to start and locate the pointed end of the arrowhead
Pick next leader point: *pick a point* Pick a point off to the right for the left-justified bearing and distance
Pick next leader point (Enter to end): *press Enter*
Options/Points/<Select line or polyline>: *press Enter*to end

26 Next, you will want to annotate the arc in the drawing. The label will consist of four entries: arc length, radius, chord bearing (angle) and chord distance.

Select the *Annotate Arc* command, on the Annotate menu, and choose the *Stack Label Arc* option. The Stack Label Arc dialog box appears.



Set the sequence column to 1, 2, 3 and 4 as shown. Remember that changes to this box apply only to this work session. To set these options permanently, go to the Settings menu, choose *Configure > Survey Settings >* and choose the *Stack Label Arc* command. When you are done with the dialog box, click OK.

Define arc by, Points/<select arc or polyline>: *pick the arc*
Pick point for labels: *pick a point* to the right to place the label
As the cursor moves, the text "ghosts", allowing you to make the best possible placement decision
Pick point to start leader at ([Enter] for none): *pick a point on or near the arc* for the arrowhead
Define arc by, Points/<select arc or polyline>: *press Enter* to end
Sometimes Carlson displays an arc as a series of chords. Type Regen at the command prompt to "regenerate" the arc. Even if an arc shows up on the screen as a group of jagged chords, it will plot as a smooth arc to a printer or plotter.

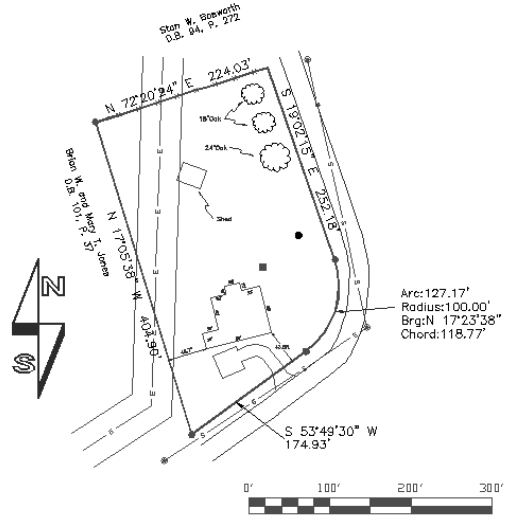
27 Next, you will label the trees, the shed, and the building using a special leader, for a hand-

drafted appearance. Under the Annotate menu, select the *Special Leader* command.

Options/Pick Arrow Location: *pick near the southern most corner of the shed*
Text location: *pick slightly down and to the right*
Text: Shed
Text: *press Enter twice* to end

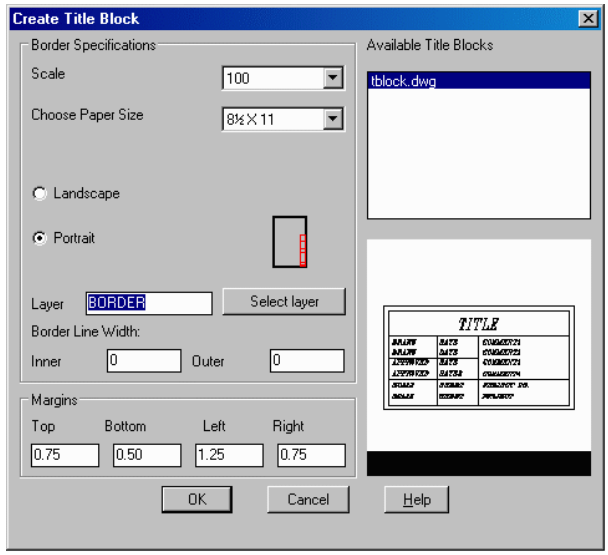
Repeat the process for all the special leader text items shown in the drawing below. In the case of the 18" Oak trees, create just one leader with text, and on the second oak tree, create only the leader, and then press Enter when asked for Text. For the best appearance, enter 18"Oak and 24"Oak with no spaces between the characters.

Your drawing should be similar to this one:



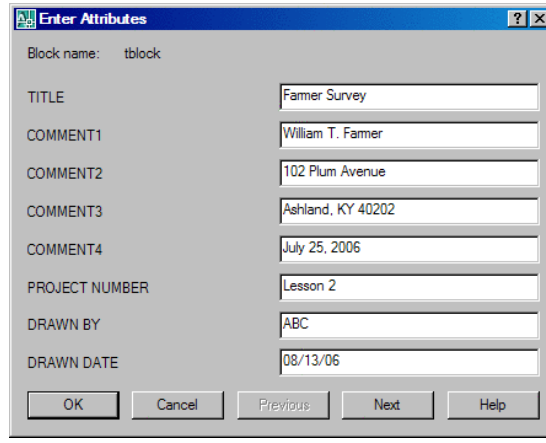
28 You can add a North Arrow and Bar Scale by selecting these options under the Annotate menu. When you place the North Arrow, pick your North Arrow symbol, maybe change the scale, and click OK. Then pick an insertion point. You place the Bar Scale by answering the prompts and picking a location. Both the North Arrow and the Bar Scale can be moved to desired locations with the Move command on the Edit menu.

29 Next, you will insert a title block with a border. Select the *Title Block* command from the Settings menu.

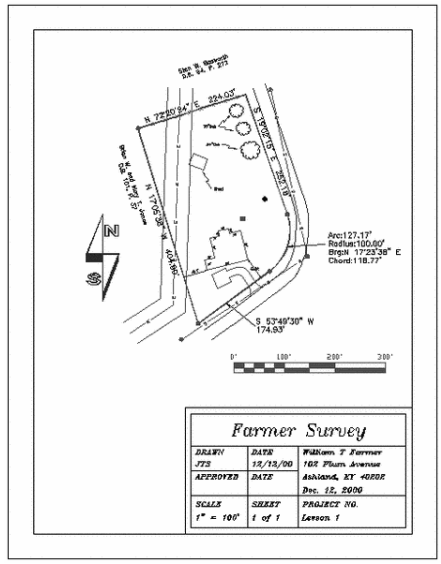


Choose paper size A1 (portrait view, 8-1/2 by 11). Click OK. Pick a point below and to the left of the survey in order to locate the lower-left corner of the border outer line. Remember that the title block will be at the bottom, so leave extra room at the bottom.

The following dialog appears, prompting you for the attributes of the title block. Be sure to also click Next in order to enter in more attributes.



Your drawing should resemble the one shown below.



30 Next, you will add a legend. On the Annotate menu, select the *Draw Legend* command. Choose the New tab, then Open the default legend name. When the dialog box appears, select Add from Drawing. You will make one pick for each symbol you want to appear in the legend. So, with the Shift key held down, select one of the sewer manholes, one of the iron pins, the concrete monument, one oak tree and the pine tree. Press enter. You will then see the symbols that you picked listed.

If you want to change the order of the items in the list, use the Move Up and Move Down buttons, after first selecting and highlighting the item to be moved. After the list is ordered correctly, highlight one item on the list and click the Edit button to edit the symbol definition.

Edit each symbol definition individually, typing the following descriptions in the description box:

SPT5 = "Iron Pin"

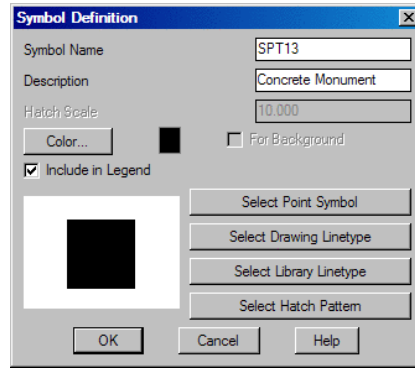
SPT34 = "Manhole"

SPT13 = "Concrete Monument"

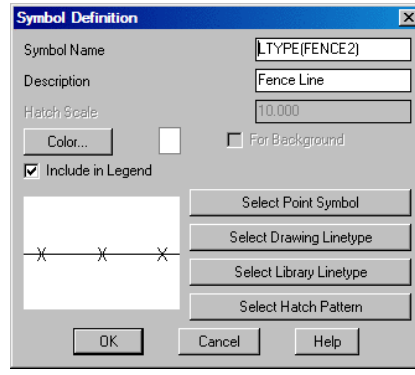
SPT 61 = "Oak Tree"

SPT53 = "Pine Tree"

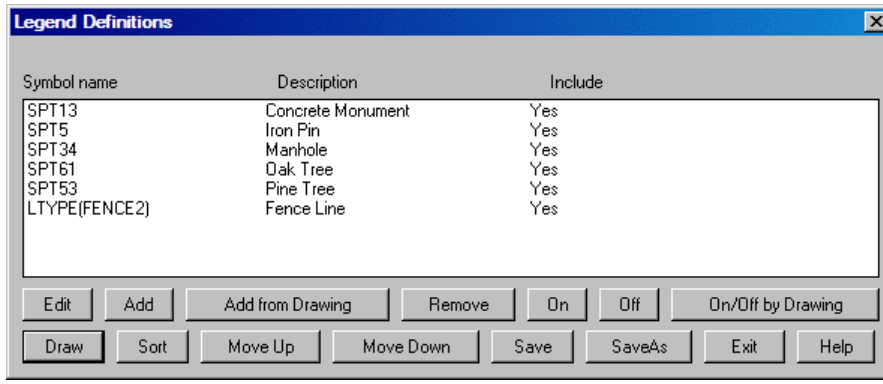
Below is the symbol definition, with Description, for SPT13.



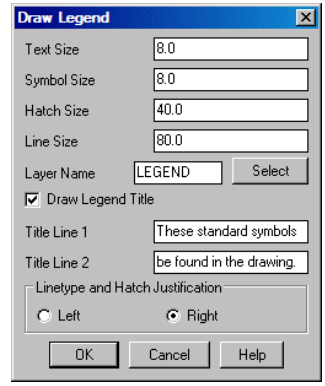
After you have entered the descriptions for the symbols, choose the Add option from the Legend Definition dialog box, and add the Fence Line type to the list by picking the Select Linetype command, as shown below:



Save the completed legend, which is shown below.

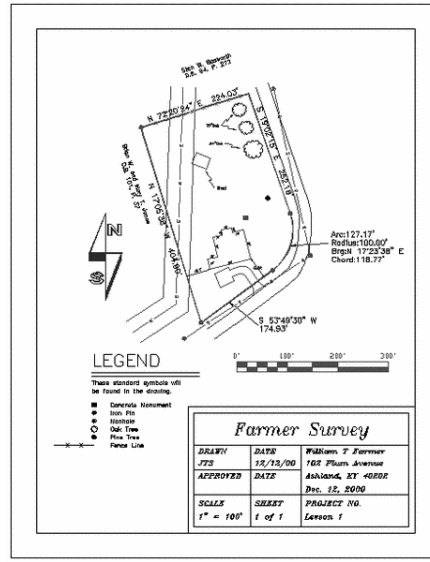


Select the Draw option from the Legend Definitions dialog box. Set the defaults as shown below.



Click OK. Pick a point for the legend, at roughly 5260,4380. Then click Exit.

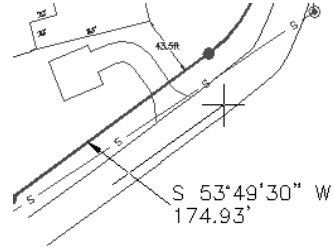
You may need to move the fence line portion of the legend to fit in the tight space. You also may need to move the previously drawn bar scale. Use the *Move* command to do this. The following shows the drawing to this point:



If you wish to reset the spacing of the sewer and electric utility annotation, use the LTSCALE box in the Drawing Setup dialog box, under the Settings menu, to set it. (The setting is 50, in this example).

31 Next, you will use Dtext to label the road and Mtext to create a certification block. Zoom in on the area shown below. At the command line, type Dtext.

Specify start point of text or [Justify/Style]: R (for right-justified)
Specify right endpoint of text baseline: *pick a point*as shown below, just to the left of the leader annotation
Specify height <8.00>: 10
Specify rotation angle of text <E>: *pick a point* as shown below by the location of the crosshair



Text: Meadow Lane

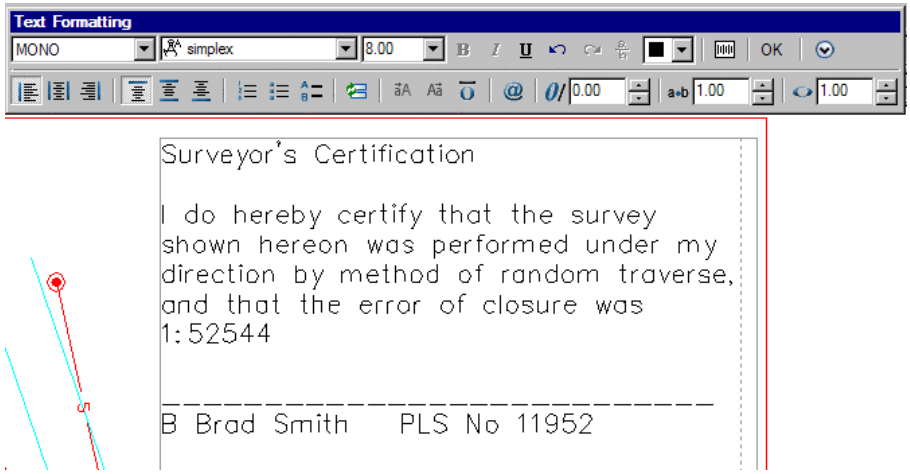
Text: *press Enter*

This right-justifies the label Meadow Lane, ending it before it contacts the leader line.

Now you will enter a certification using Mtext. The Mtext command stretches an entire block of text. This command breaks up the lines in the block of text, depending on how you edit and adjust the Mtext window. First, use the View > *Extents* command to view the entire drawing. Then, at the command line, type in Mtext.

Specify first corner: *pick a point* in the 5660,4980 range
Specify opposite corner or [Height/Justify/Line spacing/Rotation/Style/Width]: *pick a point* below and to the right of the first, but inside the inside border line.

You now see a dialog box that displays all the text heights that you have used in the drawing. Choose the text height of 8. Then type the following into the dialog box:

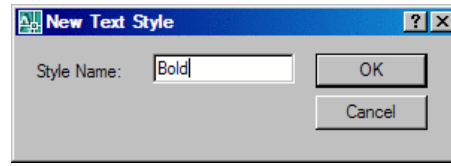

Text Formatting
MONO
simplex
8.00
OK
0.00
1.00
1.00
Surveyor's Certification
I do hereby certify that the survey shown hereon was performed under my direction by method of random traverse, and that the error of closure was 1:52544
B Brad Smith PLS No 11952

The command adds carriage returns to the text when it runs out of space in the Mtext window. Click OK at the upper right to place this text into the drawing.

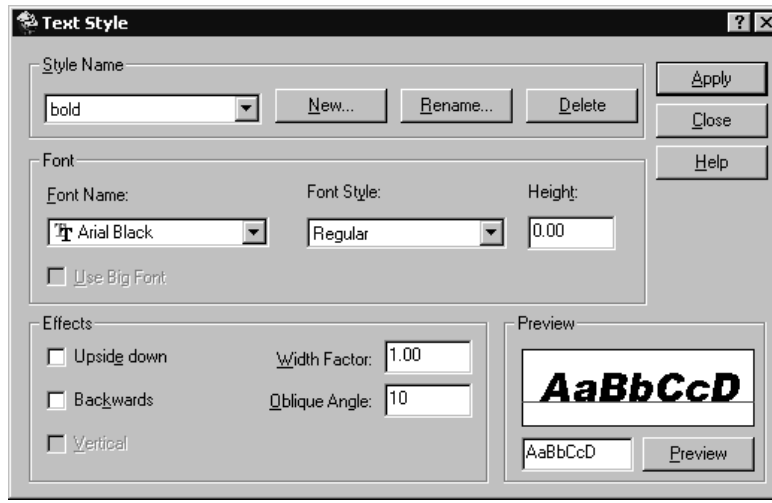
After the Mtext is plotted, you can click on the text to activate the grips. All 4 corners highlight as grips. Pick on a grip, and then you can expand or change the shape of the Mtext rectangle. When you do this, the text adjusts automatically, adding more lines and carriage returns, or condensing many lines into fewer, but longer, lines of text. You can also move the entire text block to a new location.

32 Next, you will define a text style, then add text using that style. On the Draw Menu, under

Text, choose select the *Set Style* option. The Text Style dialog box appears. Click New, enter Bold in the New Text Style dialog, and click OK.



Create a Bold Style consisting of the Arial Black font tilted at a 10 degree oblique angle, by entering the settings as show below.



Then click Apply and Close. Now, run the Dtext command by typing Dtext at the command line, and place the text at the top of the drawing as follows:

Specify start point of text or [Justify/Style]: *pick a point near the northwest corner of the drawing*
Specify height <10.00>: 20
Specify rotation angle of text <N 54d40'16" E>: E for due East
Text: William T. Farmer
Text: *press Enter twice*

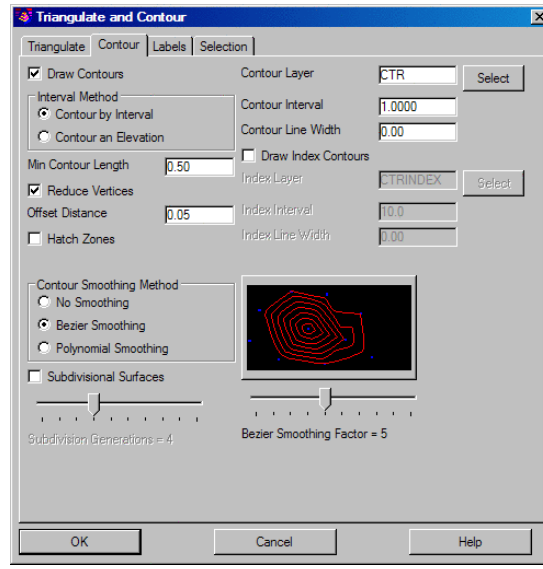
33 Next, you will create an area label for the drawing. Select the Area Defaults command, under the Area/Layout menu, and change the Precision for Other Area Labels to 2 decimal places.

Select the *Areas by Lines & Arcs* command, under the Area menu. When prompted to Select objects, pick the 2 polylines that, taken together, completely enclose the property.

Pick an area labeling centering point for the area label under the William T. Farmer title at the top of the drawing.

34 Next, bring the points back and draw a contour map. To draw the points, use the *Thaw Layer* command under the View menu. If you did not complete this lesson in one sitting, then Carlson won't "remember" what layer to thaw. In that case, select the *Layer Control* command on the View menu, and thaw the PNTS layer by turning the snowflake to a sun symbol.

Go to the Surface menu and select the *Triangulate & Contour* command. Click the Contour tab.



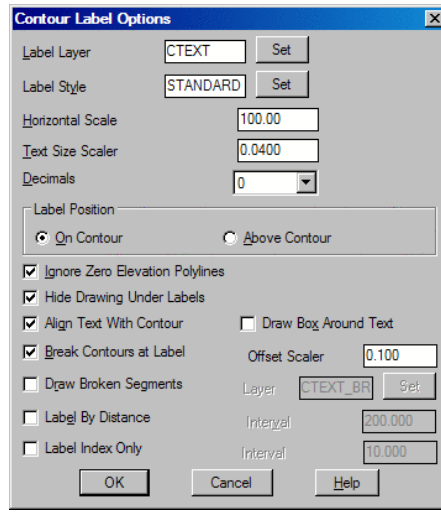
In this Contour tab section, change the contour interval to 1.0. Now click on the Triangulate tab, then click on Use Inclusion/Exclusion Areas. Press OK and then answer as follows:

Select the Inclusion perimeter polylines or ENTER for none.
Select objects: *press Enter*
We have no "inclusion" perimeter.
Select the Exclusion perimeter polylines or ENTER for none.

Select objects: *select the building and the shed while holding down the Shift key, then press Enter*
Since the building and shed are closed polygons acting as exclusion perimeters, the contours will not pass through them when they are created.
Select the points and barrier lines to Triangulate: *select a window around the points by picking from the lower left to the upper right*

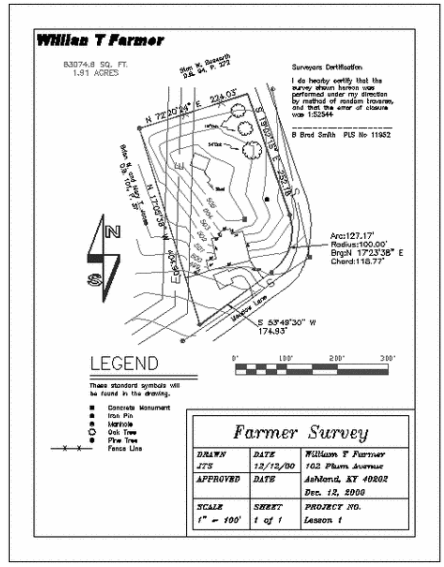
The contour map is created. Freeze the points again by using View > *Freeze Layer* and picking one of the points.

35 Next, label the contours. Select the *Contour Elevation Label* command from the Surface menu > Contour Labels. Select OK after matching the settings in the dialog box shown here:



Now pick two points that cross through one or more contours. The contours are automatically labeled using the current text style. You can use the *Change Text Font* command, part of the Text command in the Edit menu, to change the font to Romans, or to another font, if you wish to.

The Completed Plat is shown here:

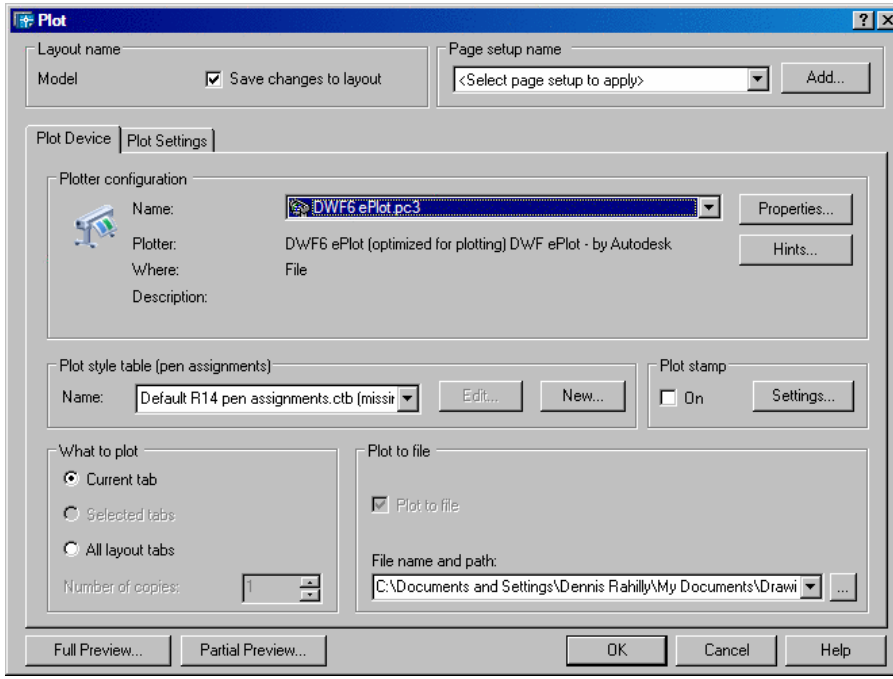


If you have not saved your drawing for awhile, now is a good time to do it. Use the *Save* command on the File menu.

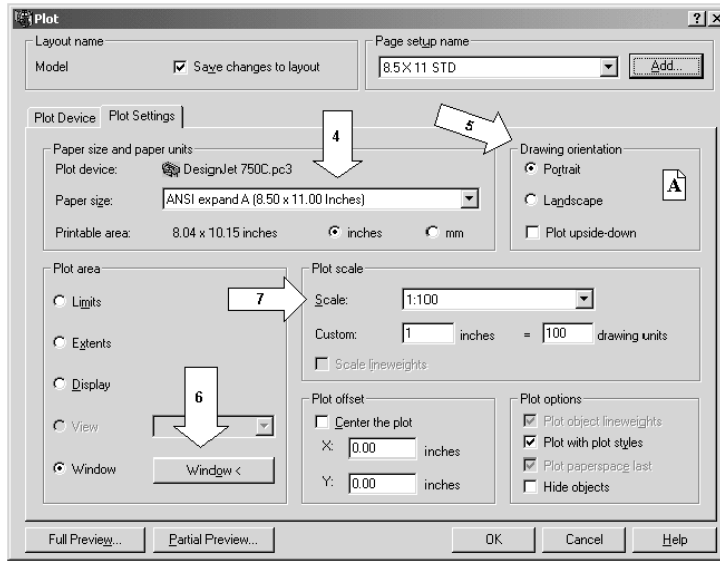
36 Now we are ready to plot the drawing.

Before plotting it's a good idea to do a Zoom *Extents*, then a *Zoom Out* (both on the View Menu) before executing the plot command.

To get started, choose Plot from the File menu. There are many variables that can affect how the dialog box will look, such as what version of AutoCAD you are using. Here is a common Plot dialog box:



With this layout, you have two tabs on the dialog labeled "Plot Device" and "Plot settings". We will start with "Plot device". The first thing to select is your plotting device (see arrow #1). Here DWF6 ePlot.pc3 is already selected, and that is what we want to use. Next, arrow #2 points to the "What to Plot" section. In this version of AutoCAD, you are either working in the model tab or one of the layout tabs. Our example is drawn in the model tab, so the option labeled "Current Tab" should be selected. If you want more than one copy of your plot, this is where you would change that number. Arrow #3 points to the plot settings tab. Click on here next. Now the dialog should look like this:



Now we are on the "Plot settings" tab. Arrow #4 points to where you can change the paper size and units. Here we chose 8.5 X 11 for our size and inches for our units. The next thing to select is the drawing orientation, arrow #5 shows you where this is. We will choose portrait.

Now looking at arrow #6, we want to choose the window button in order to select the area we want to plot. After you select this button, the dialog will disappear and you can select the upper left and the lower right corners of the drawing border. When you finish, the dialog will reappear.

The next thing to do (arrow #7) is choose the correct plotting scale, our drawing is 1"=100' or 1:100. Choose this from the dropdown list. Now we are ready to preview the plot. Press the Full Preview button in the lower left corner of the main dialog. Press ESC to return to the main dialog. One new feature starting in AutoCAD 2000 is the ability to save all the information you have just entered in a "Page Setup". In the upper part of the dialog, check on the box labeled "Save changes to layout", then to the right of that, click the button labeled "Add". A new dialog will appear, at the top of this dialog, enter a name to save your page setup as and click OK. I chose 8.5 X 11 STD. You can see this in the dialog shown above. If your plot preview looked OK, choose OK from the bottom of the dialog and your plot is on its way. The advantage to saving the page setup is that you can open this drawing tomorrow or 3 weeks later and choose 8.5 X 11 STD as your page setup, and then choose OK to plot the drawing exactly like you did today, without having to remember all the settings yourself.

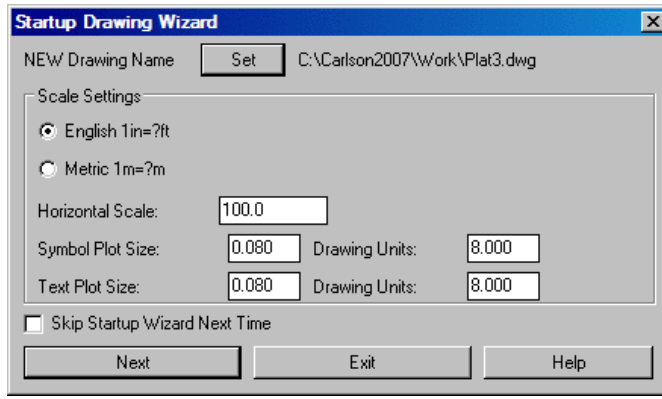
This completes the Lesson 2 tutorial: Making a Plat.

Lesson 3: Field to Finish for Faster Drafting

In this lesson, you will make a plat using field to finish techniques, with the help of the Startup Drawing Wizard.

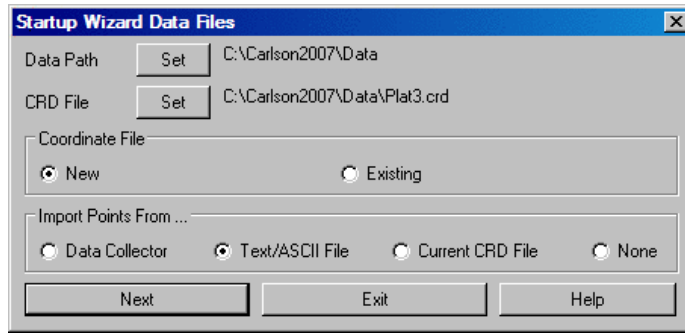
1 Launch Carlson, or, if you are already in the program, select the File menu, and select New to start a new drawing. Save your existing drawing first, if you'd prefer. If you are asked to use a template, choose carlsonxx.dwt, where xx is the last two digits of the AutoCAD release that you are working with. For example, for AutoCAD 2006, you will select carlson06.dwt.

The first of several Startup Wizard dialog boxes appears. If the Startup Wizard does not appear, then go to the Settings menu, choose *Configure* and then select General Settings. In the General Settings dialog, click Use Startup Wizard in the upper-left and click OK. Then open a new drawing again.

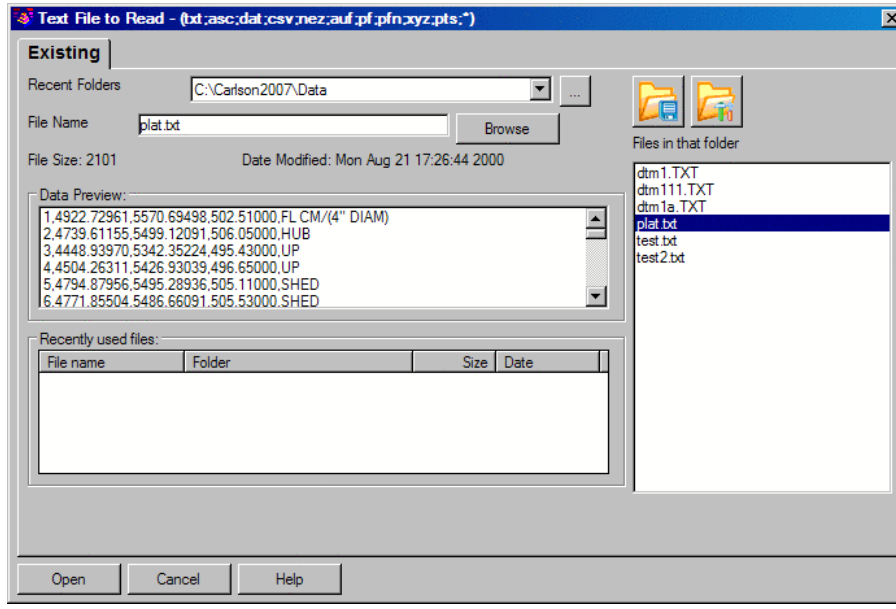


Once in the Startup Drawing Wizard, click Set at the top of the dialog box, and enter in a new Drawing Name. Since this is Lesson 3, call the new drawing Plat3.

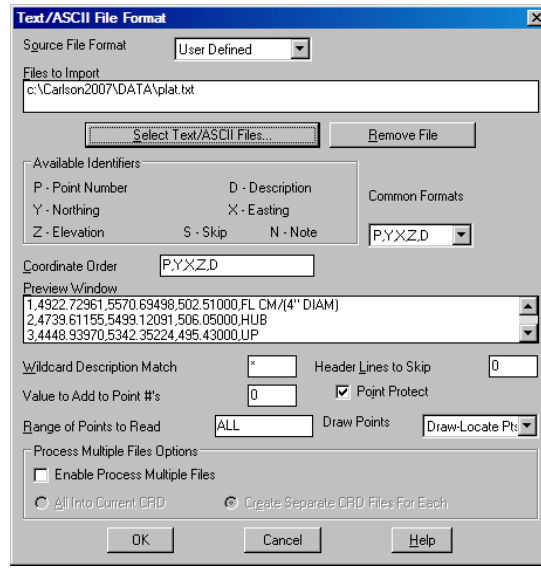
Verify that the other settings match the settings shown above, and click Next. You will see the Startup Wizard Data Files dialog. This dialog box is used to specify where to store data, and the existing point information source. Set Plat3.crd as the new CRD file name.



Our source is the same file as in Lesson 2, Plat.txt. This is an ASCII file, so click Next, and in the new dialog box click the option to Select Text/ASCII Files. In the next dialog box, titled Text File to Read, choose plat.txt from the \DATA folder, and then click Open.



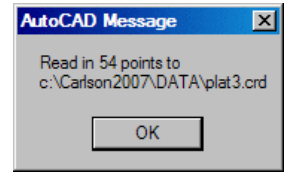
The Text/ASCII File Format dialog appears again, and the format of the points appears in the Preview Window, for verification, as shown below. Be sure that to the right of Draw Point, that Draw-Locate Pts is selected. Set the other options as shown. Click OK.



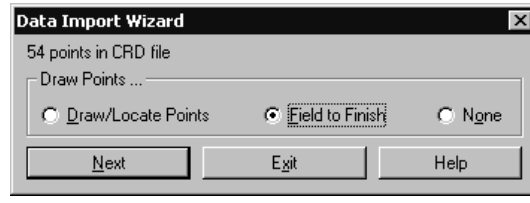
The points are then copied into the file Plat3.crd. If you repeat this exercise, and again use the file name Plat3.crd, you will be asked:

[O]verwrite w/new coordinates, overwrite [A]ll, or use number <55>: A (for all)

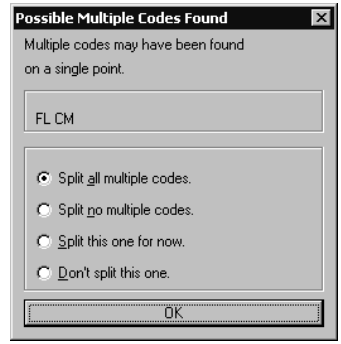
In either case, when you correctly complete the process, the following dialog box appears:



Then this Drawing Import Wizard dialog box appears:

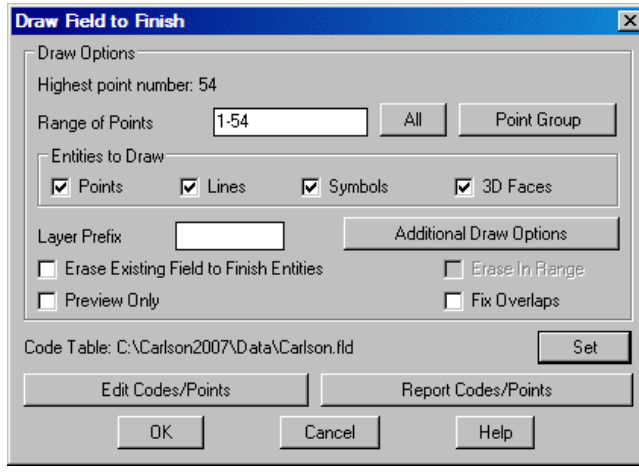


Choose the Field to Finish option, and click Next. If you receive a file selection dialog titled Specify Field Code Definition File, choose the file called "Carlson.fld". A dialog box now appears with a warning that some codes have two descriptions.

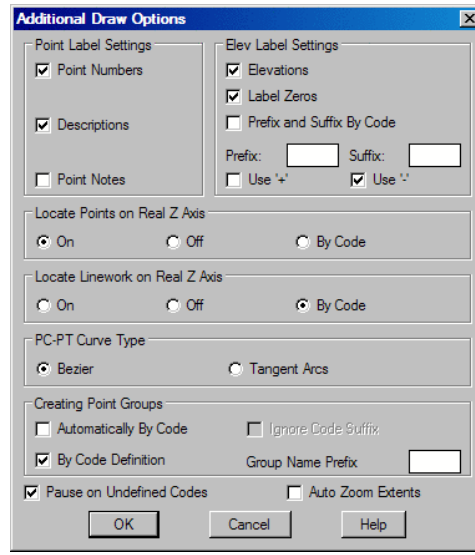

Possible Multiple Codes Found
Multiple codes may have been found on a single point.
FL CM
Split all multiple codes.
Split no multiple codes.
Split this one for now.
Don't split this one.
OK

The command is asking whether these codes are to be treated as two separate descriptions, or as one description that has a space in it. Choose the default (Split all multiple codes), to tell the command that codes with spaces are really two separate descriptions, and click OK.

The Draw Field to Finish dialog box appears. Choose the options as shown here. Then click Additional Draw Options.

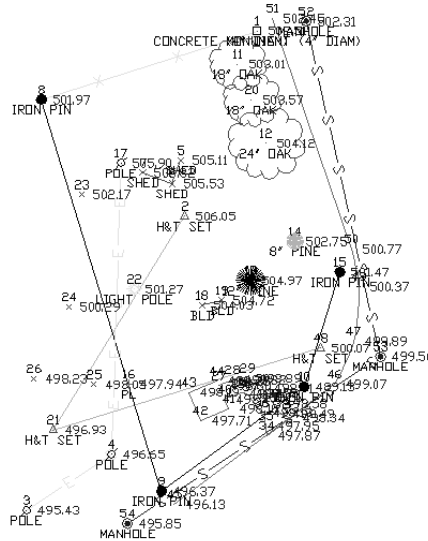


This displays a dialog box that provide many additional options, as shown below.

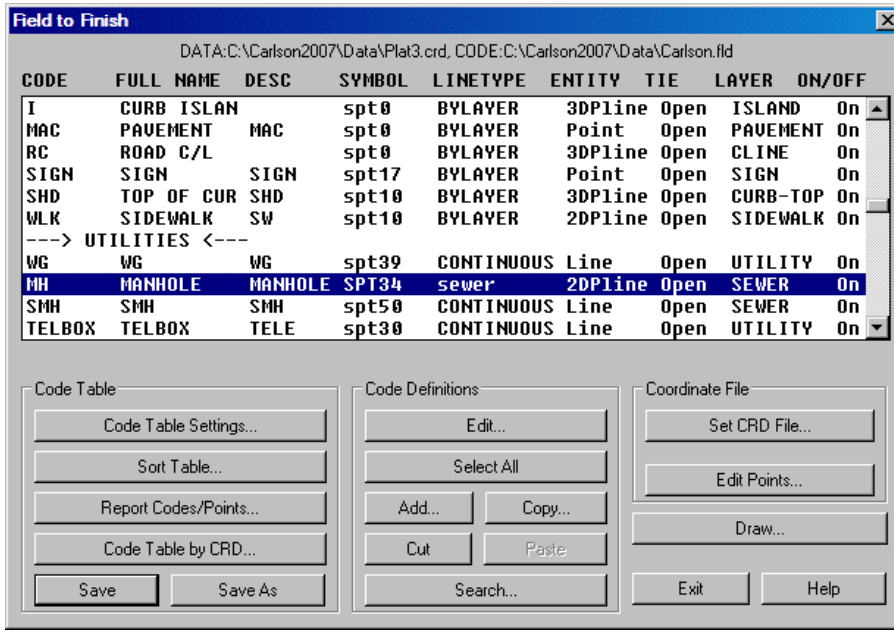


You want to draw all 1 through 54. Make sure the other options are set as shown above. Click OK twice.

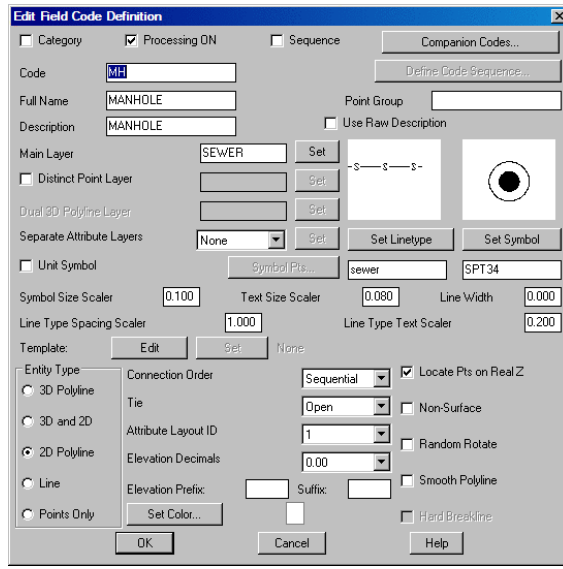
Draw Field to Finish now draws the points and linework. Got to View, and then *Extents* to show the points, as well as the linework and point symbols. *Draw Field to Finish* saves you many manual steps. Your plat is shown below:



2 To understand how the above drawing was created, select *Draw Field to Finish* again from the Survey menu, and then select the Edit Codes/Points button from the dialog box. This take you to the Field to Finish dialog box.


Field to Finish
DATA:C:\Carlson2007\Data\Plat3.crd, CODE:C:\Carlson2007\Data\Carlson.fld
CODE FULL NAME DESC SYMBOL LINETYPE ENTITY TIE LAYER ON/OFF
I CURB ISLAN spt0 BYLAYER 3DPline Open ISLAND On
MAC PAVEMENT MAC spt0 BYLAYER Point Open PAVEMENT On
RC ROAD C/L spt0 BYLAYER 3DPline Open CLINE On
SIGN SIGN SIGN spt17 BYLAYER Point Open SIGN On
SHD TOP OF CUR SHD spt10 BYLAYER 3DPline Open CURB-TOP On
WLK SIDEWALK SW spt10 BYLAYER 2DPline Open SIDEWALK On
---> UTILITIES <---
WG WG WG spt39 CONTINUOUS Line Open UTILITY On
MH MANHOLE MANHOLE SPT34 sewer 2DPline Open SEWER On
SMH SMH SMH spt50 CONTINUOUS Line Open SEWER On
TELBOX TELBOX TELE spt30 CONTINUOUS Line Open UTILITY On
Code Table
Code Table Settings...
Sort Table...
Report Codes/Points...
Code Table by CRD...
Save
Save As
Code Definitions
Edit...
Select All
Add...
Copy...
Cut
Paste
Search...
Coordinate File
Set CRD File...
Edit Points...
Draw...
Exit
Help

The display window shows a list of point codes, such as IP for iron pin and FL for fence line, that are converted to special symbols and linetypes by *Draw Field to Finish*. For an example of how the codes are used, look at the sewer line running from point 52 to 53 to 54 (the southernmost point), which is based on a field code of MH. Select MH for Manhole, as shown above, and then click Edit. The following dialog box is displayed.



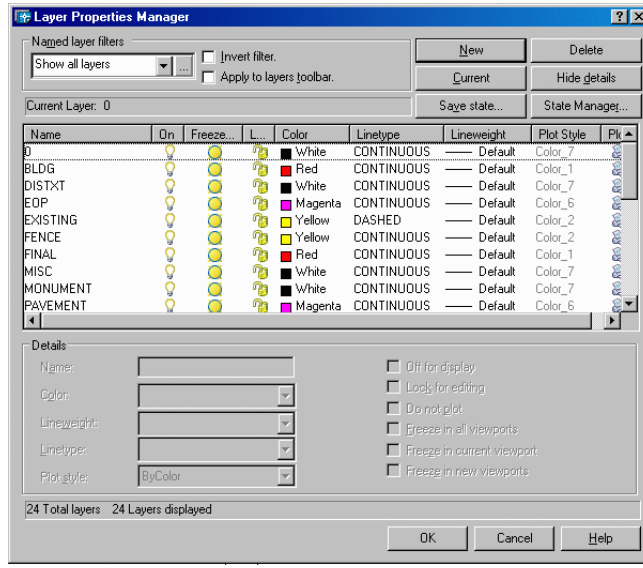
MH has several attributes that are used by *Draw Field to Finish*, based on the settings shown above. *Draw Field to Finish* draws a manhole using the symbol SPT34. It draws a sewer line with the letter S for sewer. It places the manhole on layer SEWER, and plots a text description of "MANHOLE" underneath the symbol. (Descriptions can be upper or lower case.) When you are done looking at the MH field code definition dialog, click OK.

Other codes have fewer attributes. LP is set only to draw a symbol and text (Light Pole), but not to draw linework. FL, for fence line, is set to draw linework but not corner symbols or points descriptions. A code's attributes depend on the entries in the Set Linetype, Set Symbol, Description and Entity Type options.

The "Carlson.fld" Field to Finish code table is provided with the Carlson software. This table shows one possible system, but with far too many codes for a field crew to remember. You can

make your own table by choosing the Code Table Settings option from the Field to Finish dialog box, then choose the Set button at the top right. Then select the New or the Existing tab from the top of the Specify the Code Definition File dialog box, in order to create or select a different code table (.FLD) file.

3 Use the *Layer ID* command, located under Inquiry, to verify the layers of the various plotted entities. Select *Layer ID*. Pick on the fence line, the road and the utility line, and notice the different layers (FENCE, EOP, UTILITY). You should study the layers in a drawing before deciding what to freeze and thaw. To reduce clutter on the screen, select the *Layer Control* command from the View menu. (The appearance of this dialog box might differ from what you see. It varies, depending upon what AutoCAD version is in use.)



Freeze the PNTS layer, the SPOT layer, and the PNTELEV layer by turning the sun into a snowflake. Then click OK.

4 Now you will do some drawing cleanup. Note that a single property line is drawn from point 8 to 9 to 10 and to 15. The chord from point 10 to 15 should be an arc. You will erase the segment from 9 to 10 and from 10 to 15, so that you can re-draw it, establish the tangent, then draw the arc and finish back at point 1.

To eliminate part of a polyline, select the Edit menu, then select the *Polyline Utilities* command,

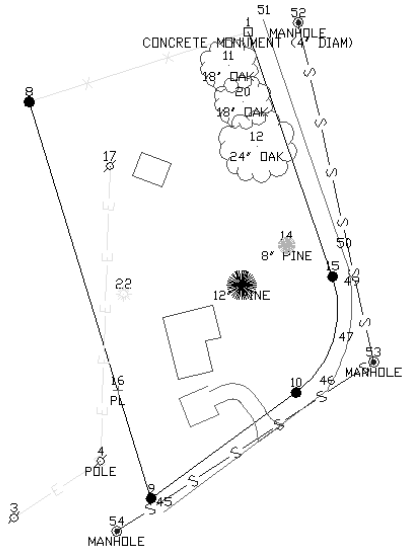
then *Remove Polyline*, and then click *Remove Polyline Segment*.

Break polyline at removal or keep continuous [<Break>/Continuous]: *press Enter* for Break
Select polyline segment to remove: *Pick the segment from 9 to 10, then the segment from 10 to 15, then press Enter to end*

To draw the correct polyline, use the 2D Polyline command under the Draw menu. If you prefer to type in the command, enter 2dp, which stands for 2D Polyline.

[Continue/Extend/Follow/Options/<Pick point or point numbers>]: 9
[Arc/Close/Distance/Follow/Undo/<Pick point or point numbers>]: 10
[Arc/Close/Distance/Extend/Follow/Line/Undo/<Pick point or point numbers>]: A
[Radius pt/radius Length/Arc length/Chord/Second pt/Undo/<Endpoint or point number>]: 15
[Arc/Close/Distance/Extend/Follow/Line/Undo/<Pick point or point numbers>]: 1
[Arc/Close/Distance/Extend/Follow/Line/Undo/<Pick point or point numbers>]: *press Enter*

Now erase the plotted traverse line that makes a "V" near the left side of the drawing. Then use the *4-Sided Building* command you learned in Lesson 2 to create the other two sides of the shed, located in the upper middle of the screen, near point 17. The end result, except the house, is shown below:



5 Much of the text in the above drawing, such as tree sizes and types, the manhole text, and the light pole text, can be used in the final drawing. But some of the text, such as the text plotted for iron pins and poles, can be fully described in the Legend without the redundancy of plotting to the screen. If you use the *Erase* command to remove the iron pin and pole text, the entire point will be erased because the attributes are grouped with the point. Instead, use the *Erase Point Attributes* command under the Points menu.

Select Point No., Elev, or Desc to Erase: *Pick the 3 poles and the 4 iron pins*

6 Next, you will use *Extend by Distance* command to create a building. The building will be less complex than the building you created in Lesson 2, but you will learn the "t" and "c" options , in addition to "l" for left and "r" for right. Under Edit, choose the *Extend* command. Select the *By Distance* option. Pick the western side of the small line segment west of the 12" pine and north of the driveway. Follow the prompts:

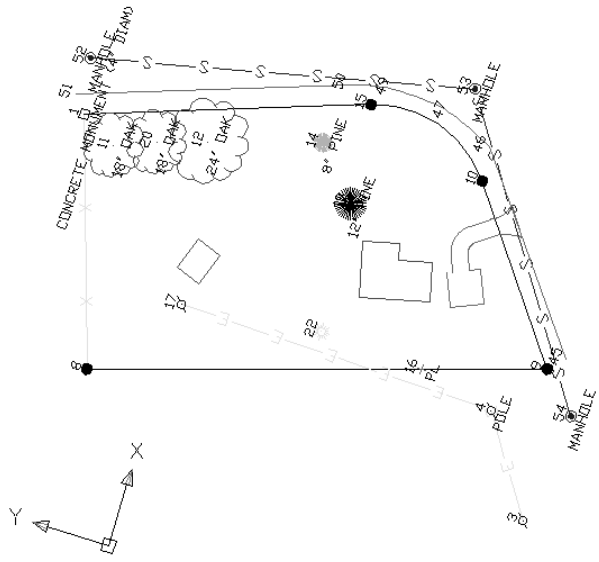
Pick line or polyline to extend:
Enter or pick distance to Draw (A,B,C,E,I,L,M,N,O,P,R,S,T,U,Z,?,Help): T50
"T" or "t" means "total" distance or "to" the distance - so extend "to" 50 feet total.
Enter or pick distance to Draw (A,B,C,E,I,L,M,N,O,P,R,S,T,U,Z,?,Help): L62.5
Enter or pick distance to Draw (A,B,C,E,I,L,M,N,O,P,R,S,T,U,Z,?,Help): L35
Enter or pick distance to Draw (A,B,C,E,I,L,M,N,O,P,R,S,T,U,Z,?,Help): L30
Enter or pick distance to Draw (A,B,C,E,I,L,M,N,O,P,R,S,T,U,Z,?,Help): R15
Enter or pick distance to Draw (A,B,C,E,I,L,M,N,O,P,R,S,T,U,Z,?,Help): C
Enter or pick distance to Draw (A,B,C,E,I,L,M,N,O,P,R,S,T,U,Z,?,Help): *press Enter*

The *Extend by Distance* "T" option for total distance solves the dilemma of making an existing line, of unknown length, extend to an exact known length.

7 Use the *Twist Screen* command to position the plat on the sheet. Not every drawing can be plotted "due North." Sometimes North needs to be rotated so that property lines and important features run nearly left-to-right or top-to-bottom on the plotted page, for a better fit. In this drawing, you want the western line from point 8 to point 9 to run left-to-right on a sheet that will be plotted in landscape style (longer left-to-right than top-to-bottom). Under the View menu, select *Twist Screen*, then *Line, Polyline or Text*.

Pick a line, polyline or text to make horizontal: *Pick the western line* from point 8 to point 9, closer to point 9

Now the drawing appears as shown below:



Notice that the north indicator (referred to as the USCICON), at the lower left, displays the rotation.

8 Now select *Twist Point Attributes*, under the Points menu, to twist the point descriptions and point numbers back to a left-to-right rotation.

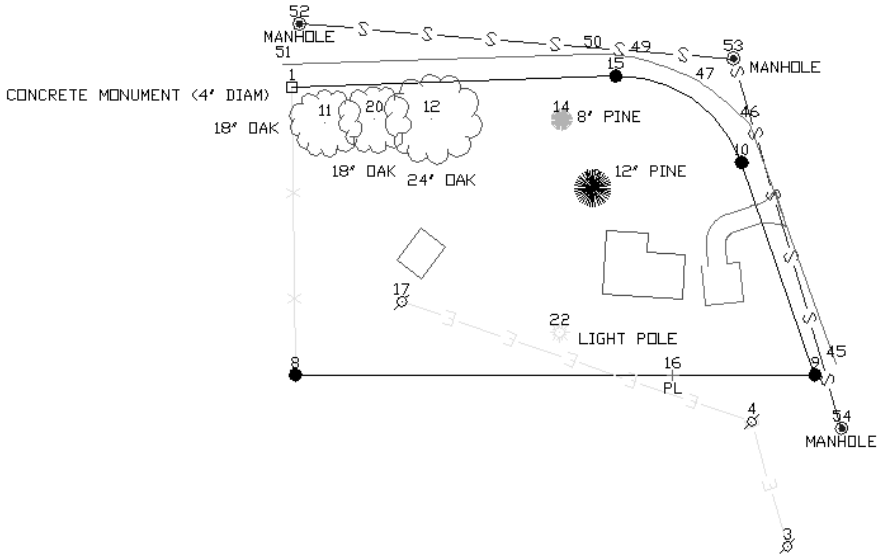
Twist by [<Twist screen>/Azimuth/Entity segment/Follow polyline]? *press Enter*
Enter angle relative to current twist screen <0.0>: *press Enter*
Select points from screen, group or by point number [<Screen>/Group/Number]? *press Enter*
Select Carlson Software points.
Select objects: ALL *press Enter*

The points then twist back orthogonal to the screen, reading once again left-to-right.

9 The remaining descriptions associated with the points can be used in the final drawing, but they should be moved slightly for a better appearance. For example, the tree descriptions would look better if they were not inside the tree canopies.

Under the Points menu, select *Move Point Attributes - Single*. The steps of the command are: pick text, pick the new text position, press Enter, press Enter. Then the command repeats. Notice how

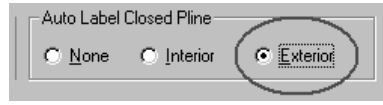
the text "ghosts" as it moves, which helps you place it in the best position. Try to duplicate this result:



10 Because of the earlier *Twist Screen* command, the E's in the electric utility polyline are upside down. Choose the *Text* command, from the Edit menu, and select the *Flip Text* option. Select the text to flip.

Select objects: *pick the upside down E's* individually while holding down the Shift key

11 To label the dimensions of the building automatically, you must first activate the Auto Label Closed Polyline Exterior function. To make this a permanent setting, under the Settings menu, select *Configure*, then Survey Settings, and then Survey Text Defaults. Change the dialog box as shown below:



Click OK, and Exit back out. Select *Building Dimensions* from the Annotate menu, which is under the *Survey Text* command. Pick on the house. If the text overwrites the inside corner of the house, use the *Move* command (under the Edit menu, or type M for Move at the command prompt) and move the 30' dimension beneath the line.

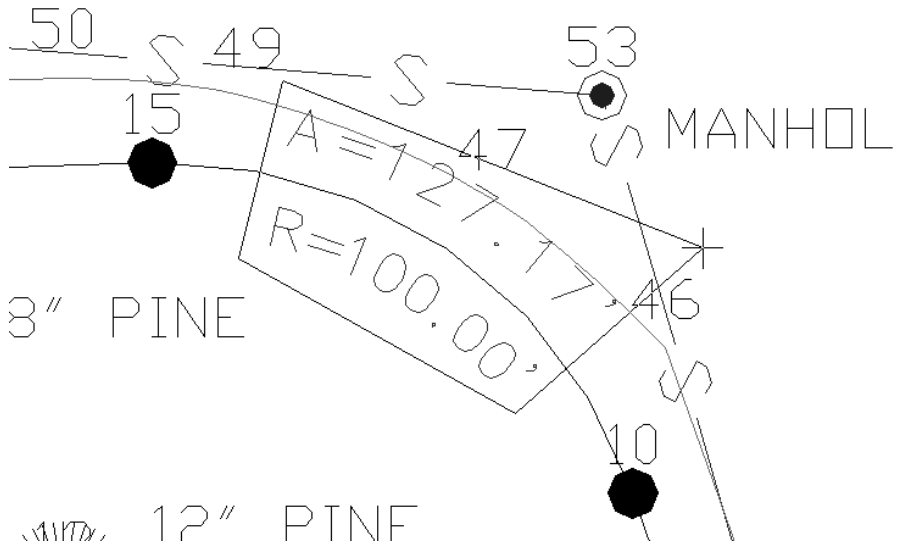
12 To automatically annotate bearings and distance, as well as arcs, select the *Auto Annotate*

command from the Annotate menu. When the dialog box appears, under the Lines tab, select the options you would like to use so that the bearings and distance labels appear as you would like. Then pick the three polylines that fully define the perimeter: the fence line, the polyline containing the arc, and the lower polyline, which is still the western polyline although you have twisted the screen so that it runs along the lower portion of the drawing. Use the *Move* command to move the bearing and distance labels to avoid overwriting other features.

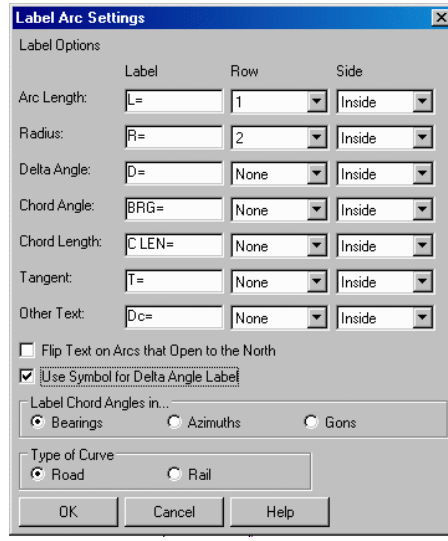
When you move the lower distance label, 404.90' to the left, you want to move perfectly level to the screen, since this was the line you used to twist the screen, and it runs perfectly left-to-right. To do this, press the function key F8 to activate Ortho. Then pick 404.90' and move it to the left, picking its final position. Repeat this for the S 17°05'38" E bearing. After you move these items, press F8 again to turn off Ortho. Sometimes you will load a drawing from another client or source, and the Ortho setting has been left on. This may initially confuse you during the *Move* commands. Press F8 to deactivate Ortho. Notice that F8 works even with Twist Screen active.

13 *Auto Annotate* typically centers the arc annotation above and below the arc, which causes the arc data to overwrite the surveyed edge-of-pavement (EOP) polyline. You want to erase both the arc annotations, and use the *Label Arc* option of the *Annotate Arc* command to force both the arc length and radius to be drawn beneath the arc.

At the command line, enter E for Erase.
Select objects: *enter WP*, then pick as shown below
Press Enter when the selection set is complete. There is no "close" option for window polygon and crossing polygon selections.



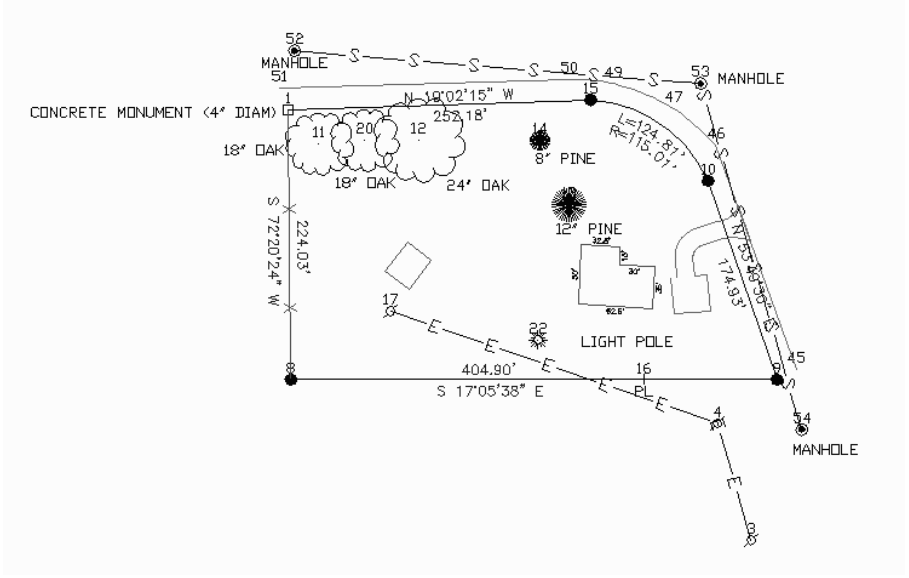
For the new annotation, under the Annotate menu, select the *Annotate Arc* command, then the *Label Arc* option. Then select the arc from the screen. The Label Arc Settings dialog box appears:



You want to locate the arc text inside the arc, on positions 1 and 2. Position (Row) 1 is just under the arc, and 2 is under 1. Be sure they are both Inside. Fill out the dialog box as shown above, and click OK.

The new arc text might overwrite the 8" Pine, so, if it does, use the command *Move Point Attributes - Single*, in the Points menu, to relocate the 8" Pine description.

With the annotations placed in new positions, your drawing should be similar to the one shown below. Move your annotations to match this drawing.



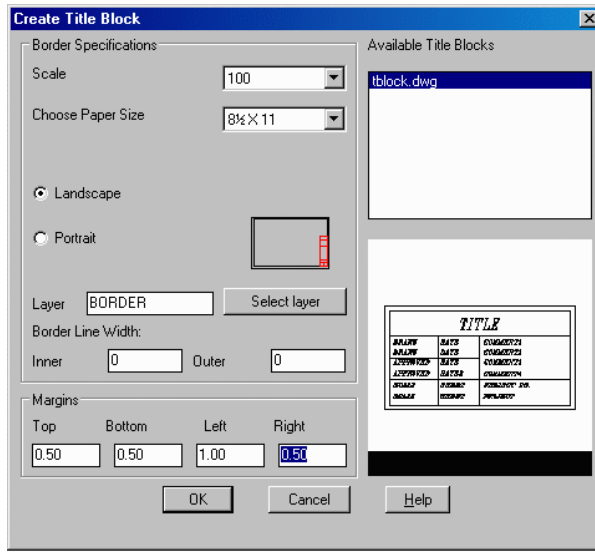
14 To label the area of the lot, first select the *Area Defaults* command from the Area/Layout menu. Set the Square Units (s.f.) to the nearest whole unit (no decimals) and the Other Area Labels to 2 decimal places. Then click OK to exit the dialog box. Select the *Area by Lines & Arcs* command from the Area/Layout menu, and pick the three polylines individually, while holding down the Shift key, that define the property perimeter. Press enter, and locate the text to the left of the 12" Pine.

15 Before completing the final formatting of your drawing, you need to do some minor cleanup, using procedures you learned in Lesson 2.

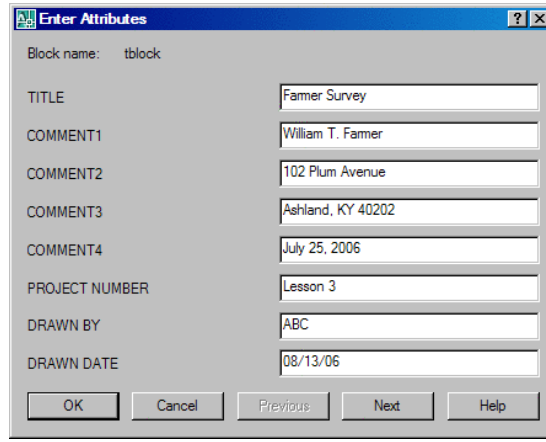
You don't want point 16, the PL point, to show in the final drawing. Use the *Layer ID* command,

under the Inquiry menu, to verify the layer of point 16, which should be MISC. Freeze MISC using the *Freeze Layer* command on the View menu, and pick point 16. Freeze the point numbers using the *Layer Control* command on the View menu, and freeze the layer PNTNO.

16 To insert an A1, 8-1/2 x 11 border and title block, with the orientation landscape (not portrait), select the *Title Block* command from the Settings menu. You will see this dialog box.



Be sure these above selections match your own. Click OK. For the insertion point, select a point at the very lower-left of the screen, so that your drawing plan entities fit inside the border and somewhat nearer to the top. Pick your screen location. You will then be prompted for the attributes of the title block. Fill them in and click OK.



If you prefer, you can use the *Move* command, pick the title block and two border perimeters, and move them. Never move the drawing, because you will change the coordinates if you do. Move the drawing only if changing the coordinate locations does not matter.

17 Select the *Draw Legend* command, under the Annotate menu, select the Existing tab, choose the .lgd file that you saved in Lesson 2, and click Open. Then select Draw and OK, to close out the dialog boxes that follow, and then click Exit.

Pick an upper-left location point in the available space to the lower-left of the plat. If you did not save a legend in Lesson 2 (or you skipped Lesson 2), follow the steps in that lesson. Use the *Scale Point Attributes* command, under the Points menu, and scale up the oak tree symbol in the Legend by a factor of 1.5.

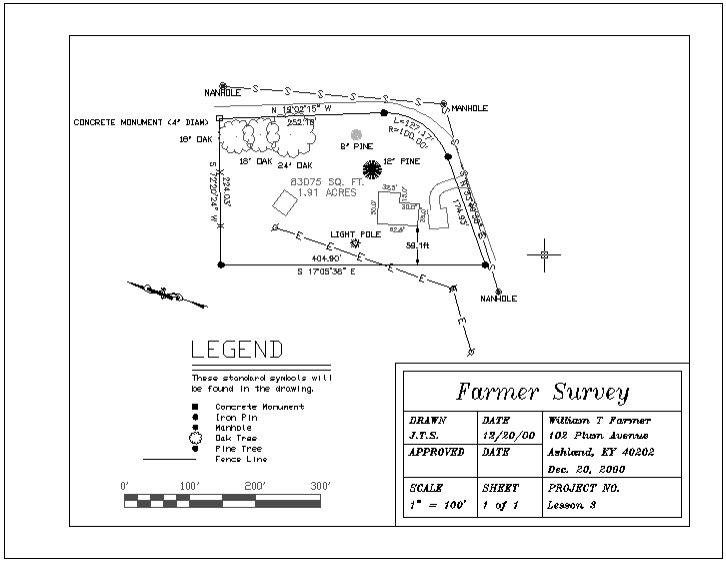
Select the *Survey Text* command from the Annotate menu, then select *Survey Text Defaults*. Change the Offset Dimension Text alignment to Horizontal. (It may have been set to Parallel in Lesson 2.) Click OK. Now select the *Offset Dimensions* command from the Annotate menu, under the *Survey Text* command, and pick the lower right corner of the building, then the lower-most property line (in the current twist screen position). This labels the offset dimension horizontal to the current twist screen.

Pick the *Draw North Arrow* command, under the Annotate menu, and select and find the north arrow symbol that is shown in the figure below. Change the Symbol Size Scaler, if necessary, and click Specify Rotation On-Screen. Click OK. Then pick an appropriate location and press Enter. Note how the arrow draws due north, respecting the twist screen.

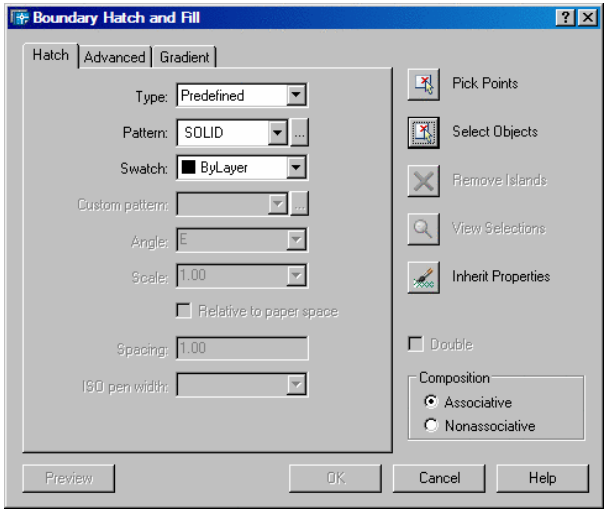
Choose the *Draw Barscale* command, under the Annotate menu, and pick a location near the

lower-left portion of the drawing.

Your drawing should now look similar to this:



18 Select the *Hatch* command from the Draw menu.



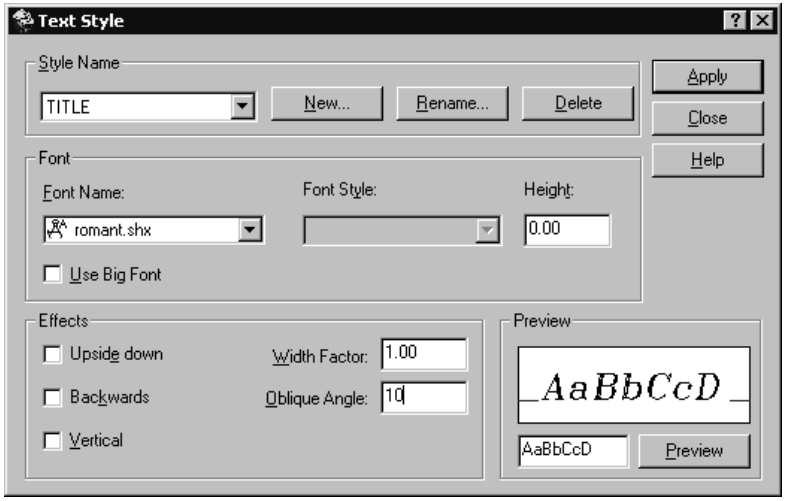
Select the SOLID pattern from the pulldown list, then click the Select Objects button. Pick the house and the shed, and press Enter twice.

19 To offset the EOP Polyline, first try using the *Standard Offset* command under the Edit menu, and try offsetting the edge-of-pavement polyline that runs roughly parallel to the sewer line. You will see an error message because that object is a 3D Polyline, created by the *Draw Field to Finish* command.

To offset a 3D Polyline, you must use a command specifically designed to offset 3D Polylines. Under the Edit menu, select *3D Polyline Utilities*, and slide over to *Offset 3D Polyline*.

Enter the offset method [<Interval>/Constant/Variable]: *press Enter*
Vertical/<Horizontal offset amount>: 30
Percent/Ratio/Vertical offset amount <0>: *press Enter*
Select a polyline to offset (Enter for none): *pick the EOP polyline*
Select side to offset: *pick out and away from parcel*, for the other side of the road

20 Before you add a title to the drawing, create a text style for the title. Choose *Set Style* in the Draw menu, found under *Text*.



Click New, and name the style Title. Choose the font named romant.shx, and then change the oblique angle to 10 degrees as shown. Click Apply, then click Close. Now, to create the title, type Dtext at the command line. Make sure that TITLE is the current text style.

Specify start point of text or [Justify/Style]: C
Specify center point of text: *pick a point* near the top-right of the screen
Specify height <8.00>: 20
Specify rotation angle of text <E>: *pick a point to right of first point* with <Ortho on>, dynamically stretch right
Text: Farmer Survey
Text: August 15, 2006
Text: *press Enter*

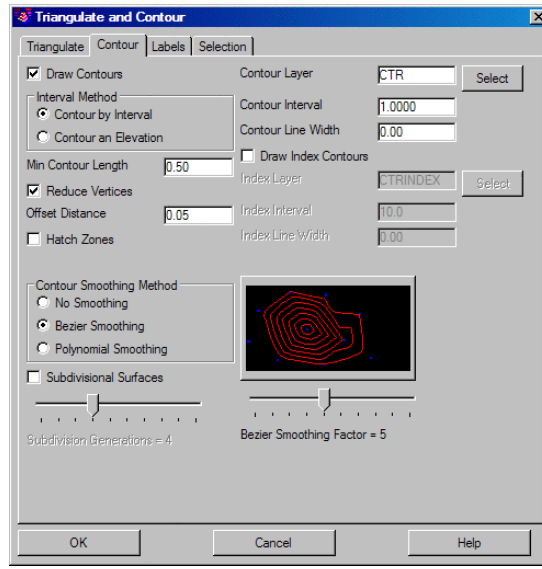
Select the *Text Enlarge/Reduce* option of the *Text* command under the Edit menu. Enter a Scaling Multiplier of .8 and pick the date you just entered.

21 Verify your drawing scale using the *Drawing Setup* command under Settings. Your drawing should have a scale of 100 with a Text Plot Size of 0.08. Change the Text Plot Size to 0.06 to shrink the the building dimensions. Then label the house "2-Story", "Farm House" (2 lines of labeling), select the *Leader with Text* command under the Annotate menu.

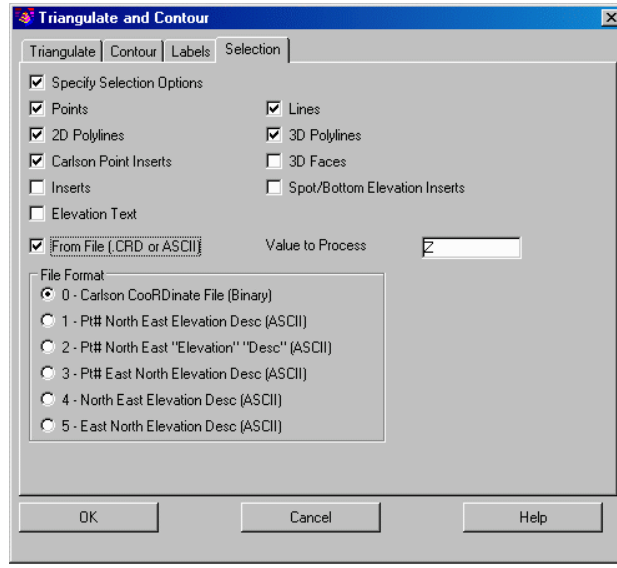
Options/Pick Arrow Location: *pick near or on the left side of the house*
To point: *pick off to the left*
Next point (Enter to end): *press Enter*
Text: 2-Story
Text: Farm House
Text: *press Enter*

Pick anywhere on the leader. You see two grip squares (usually yellow), one on the left side and one of the right side. Pick on the right grip nearest the house. Move your cursor. Note how the arrow moves. Pick again for the new location, and note how the arrowhead and leader are now located and angled to your specifications.

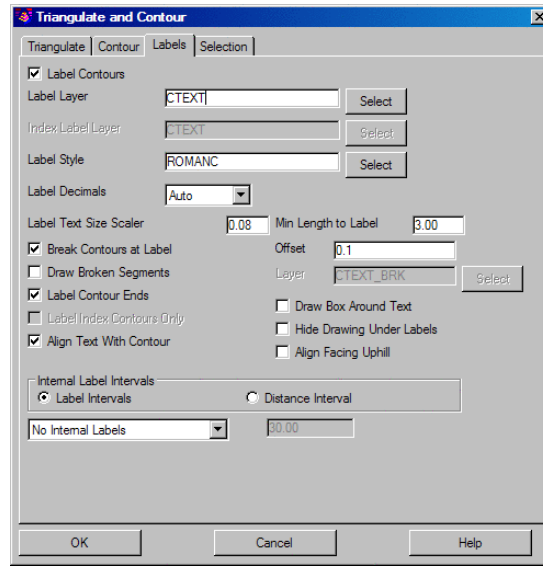
22 Select the *Triangulate & Contour* command from the Surface menu. The Contour tab of dialog box should be filled out as shown below:



Click on the Selection tab and fill out to match the following:



Click on the Labels tab and match the following dialog:



Click OK.

Select the Inclusion perimeter polylines or ENTER for none.
Select objects: *press Enter*
Select the Exclusion perimeter polylines or ENTER for none.
Select objects: *Pick the house and the shed.* Since these objects have now been filled, the selection may be a little more tricky. We could (actually should) have placed the solids on their own layer and froze the layer before beginning the contour command. But we can use the fact that Carlson is filtering the objects to get around the problem. When prompted to select the objects, issue the C (for crossing) option, then pick a box that crosses the edge of the filled polylines. Carlson will accept the polyline but reject the fill.
Select the points and breaklines to Triangulate. Select a right-to-left window of the property. A right-to-left selection behaves as a crossing, which means that any object that is touched by the window or included inside the window is selected. (A left-to-right selection is a window selection, which means that only objects that are fully enclosed by the window are selected.)
Select objects: *pick Window location*
Other corner: *pick other location*
Select objects: *press Enter to end*
Pick the coordinate file that contains the points, plat3.crd, and click Open.
Reading points ...
Range of Point Numbers to use [<All>/Group]: *press Enter*

Wildcard match of point description<*>: *press Enter*

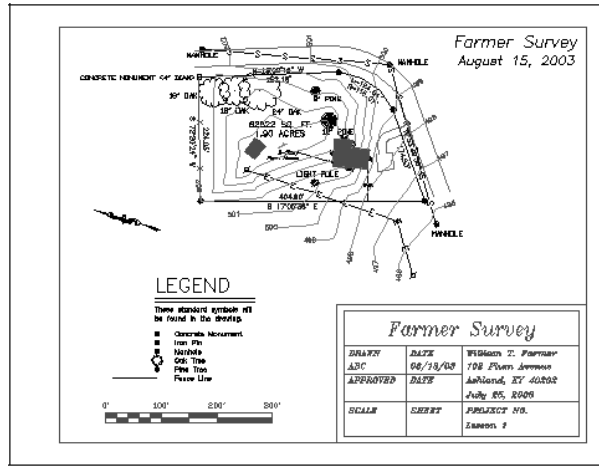
If the triangulation lines and faces were drawn, freeze them now. Next, pick the lower-left elevation "502" contour near the end. The grips are displayed. The grips near the contour end can be used for stretching. Straighten out the end of this contour line.

**** STRETCH ****
Specify stretch point or [Base point/Copy/Undo/eXit]: *pick a grib and pick a point*

**** STRETCH ****
Specify stretch point or [Base point/Copy/Undo/eXit]: *prck another grib and pick a point*

Press Enter. Clicking the right button on your mouse is the equivalent to pressing enter.

The final drawing will look similar to this:



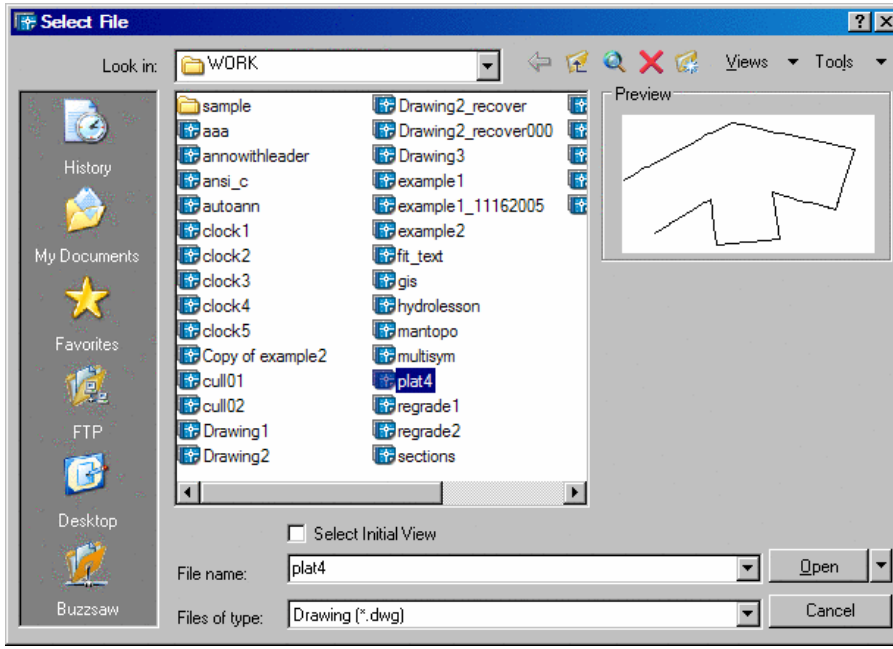
This completes this Lesson 3 tutorial titled Field to Finish for Faster Drafting.

Lesson 4: Intersections and Subdivisions

1 Click the icon for Carlson and start up Carlson Software from Windows. Once in the program, exit the Startup Wizard if it appears.

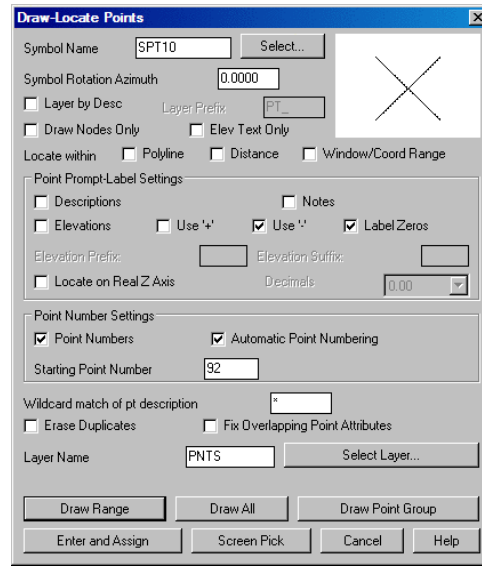
2 Once in Carlson, click *Open* under the File pulldown menu. Look for the file Plat4.dwg and click on it. When it lights up blue, as shown below, it will appear in the Preview Window at right.

It should look like the open-sided property shown here. Plat4.dwg is found within the WORK folder of Carlson. You search for the file as you typically would in Windows, clicking the yellow "Up one level" button to go to the parent folder of the current folder, or by clicking the adjacent down arrow to find the desired path in the full tree of folder locations.



Now click Open to select and open the file Plat4.dwg.

3 Enter & Assign a Starting point for the Street Centerline. Select *Draw-Locate Points*, found under the Points pulldown, and obtain the dialog shown below:

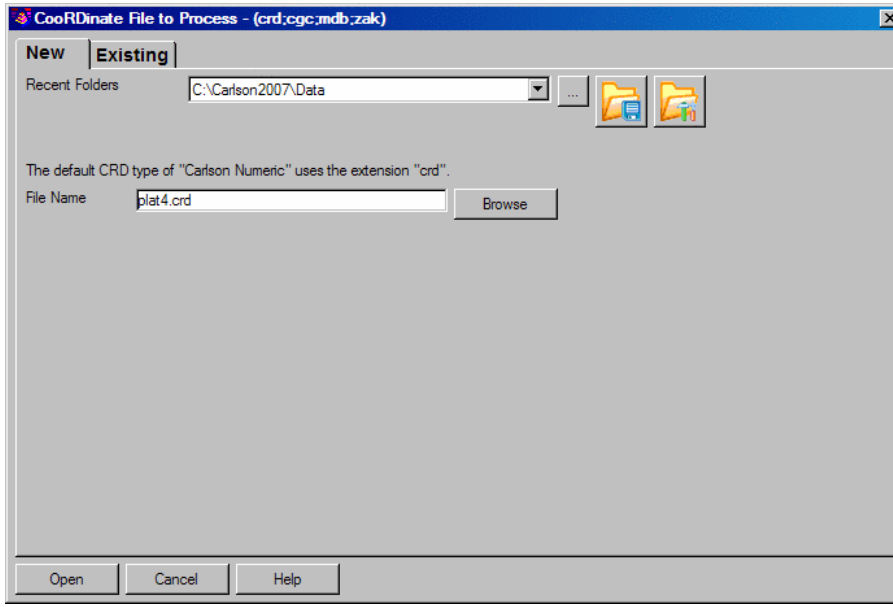


Click off the prompting and labeling for Descriptions, Elevations and Locate on Real Z Axis (make them blank as shown). Up top, change the symbol to SPT10 by picking Select at the very top of the dialog, and choosing symbol SPT10 from the dialog of symbol choices (not shown here). Also, verify that Automatic Point Numbering is clicked on, that the Starting Point Number is 1, that the layer is PNTS. Match these entries (which are mostly the default conditions) and click Enter and Assign at the lower left.

Prompting will appear at the bottom of the screen. We will enter the starting point as follows:

Enter North(y): 4809.17
Enter East (x): 4391.28

The program will recognize that you have not yet started a coordinate file, so click the New tab and enter the File Name as Plat4.crd (which should be the default). If you enter Plat4, you do not need to enter the extension .crd. The program will add extensions automatically. You will see this:



Click Open. You will be prompted again:

Enter North(y): *press Enter* (for no more points; we are done)

4 Traverse from PI to PI (to the two endpoints of our centerline). Select *Traverse* under the COGO menu, or alternately just enter T at the command line. (T is a hot key. Other hot keys are I for Inverse and SS for Sideshot). Reply to the prompts as follows:

Traverse, Line OFF, RAW FILE OFF
Exit/Options/Arc/Points/Line/SideShot/Inverse/Angle-Bearing Code <7>: 1
Enter Bearing Angle (dd.mmss) <90.0000>: 58.1848
Points/<Distance>: 736.73
N: 5196.15 E: 5018.19 Z: 0.00
Exit/Options/Arc/Points/Line/SideShot/Inverse/Angle-Bearing Code <1>: E (to exit)

You could keep on traversing, but we will stop here to review. You have created point 2, traversing NE from point 1. To review, code 1 is for NE, 2 for SE, 3 for SW, 4 for NW, 5 for Azimuth, 6 for Angle Left, 7 for Angle Right, 8 for Deflection Left and 9 for Deflection Right. This is the standard way that traverses and sideshots are entered in Carlson with a code entry (followed by Enter), then the angle or bearing entry (followed by Enter). Lesson 1, the Entering a Deed lesson, presented another method, where the angle and bearing are together in the form of 158.1848. That

is a rare form, designed to save keystrokes, and used primarily only in *Enter Deed Description*. Now you have been exposed to both!

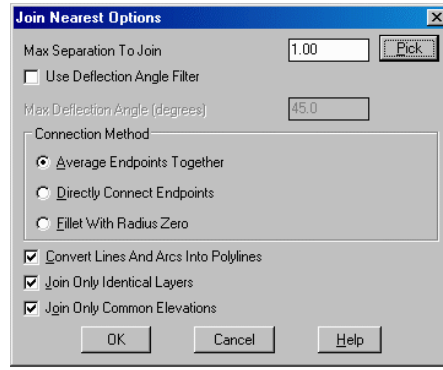
5 Line On/Off. Click *Line On/Off,* under the COGO menu, to turn on simultaneous linework with traversing. This command toggles on and off each time you click it, with the On status indicated by a check mark. Now repeat the Traverse command. Try T for Traverse this time, entered at the command line.

Traverse, Line ON, RAW FILE OFF
Exit/Options/Arc/Points/Line/SideShot/Inverse/Angle-Bearing Code <1>: 2
Enter Bearing Angle (dd.mmss) <58.1848>: 75.0627
Points/<Distance>: 553.69
N: 5053.85 E: 5553.28 Z: 0.00
Exit/Options/Arc/Points/Line/SideShot/Inverse/Angle-Bearing Code <2>: E (to exit)

6 Draw a Polyline from Point 1 to Point 2, and connect the segments with Join Nearest. We could have turned linework with traverse on before we got started, but now we will do it after-the-fact. So choose *2D Polyline* under Draw. Some users like to simply type in 2DP at the command line that starts the Polyline command, also.

[Continue/Extend/Follow/Options/<Pick point or point numbers>]: 1
[Arc/Close/Distance/Follow/Undo/<Pick point or point numbers>]: 2
[Arc/Close/Distance/Extend/Follow/Line/Undo/<Pick point or point numbers>]: *press Enter* (to end)

Now we have two line objects. The first, from point 2 to point 3 is a pure Line. The second, from point 1 to point 2, is a true Polyline (even though it is only one segment long). It is officially a LWPOLYLINE, a lightweight polyline. This can be verified by picking it using the *List* command under Inquiry. Polylines are linked combinations of one or more line segments that behave as one unit. We encourage use of polylines versus lines because they offset as a unit, will take on a thickness or width, are easier to select and have superior editing capabilities. A line can be turned into a polyline by picking *Polyedit* under Edit, picking the line, and answering Y to the question "Do you want to turn it into one? <Y>". To join the polyline and line objects into a single polyline, choose the very useful command Join Nearest, found under Edit.



The defaults are good. Just click OK. Now pick the polyline from 1 to 2 and the line from 2 to 3, and then hit Enter for no more.

Now, see the grips on the new polyline by picking it with the cursor. See how the whole thing highlights? That is proof that it is joined up as a polyline.

7 Design a Curve with a 500' Radius. Under Draw, pick *Arc* and slide over to *2 Tangents,Radius*.

Radius of Arc <0.00>: 500
[nea] Pick Point on 1st Tangent Line: *Pick on the 1st polyline* segment closer to point 2
[nea] Pick Point on 2nd Tangent Line: *Pick on the 2nd polyline* segment close to point 2

The arc draws in, and the centerline remains a polyline, now with 3 segments.

8 I for Inverse. Entering I for Inverse, at the command line, is a handy way to get on a point to begin another traverse. Practice inversing. Enter I. Inverse from point 1, then to point 2, then to point 3 then back to 1. But you can also inverse (go to) a snapped position on a line or polyline, such as the midpoint of an arc. Let's do that, because we want to traverse south from the midpoint of the arc. Enter I, for Inverse.

Calculate Bearing & Distance from starting point?
Traverse/SideShot/Options/Arc/Pick point or point number: MID (for midpoint snap) of *Select the arc*
Traverse/SideShot/Options/Arc/Pick point or point number: T (for traverse)
Traverse, Line ON, RAW FILE OFF
Exit/Options/Arc/Points/Line/SideShot/Inverse/Angle-Bearing Code <2>: *press Enter*
Enter Bearing Angle (dd.mmss) <75.0627>: 10.11
Calculated Bearing (Qdd.mmss): 210.1100
Points/<Distance>: 400

Exit/Options/Arc/Points/Line/SideShot/Inverse/Angle-Bearing Code <2>: *E* (to exit traverse)

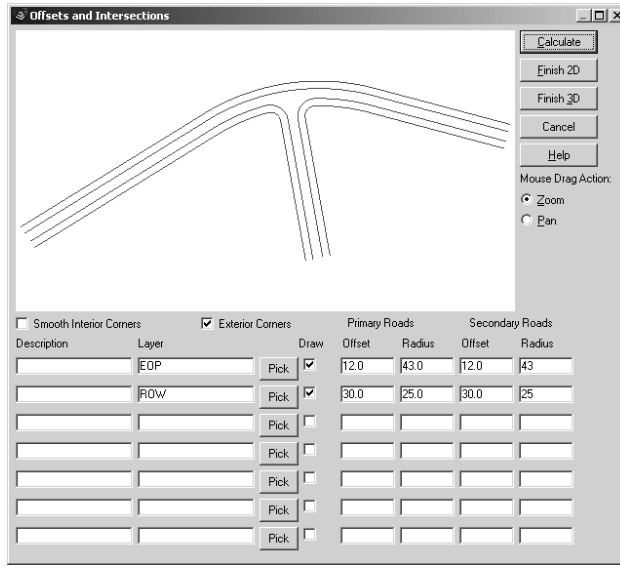
Notice that you can transition from inverse, to traverse, to sideshot, etc. with these COGO options. We were in inverse, but we did T for traverse, and could have done I for inverse to return to inverse. This cuts down on keystrokes, and adds to the sense of fluidity of the software.

9 Turn a Line into a Polyline with Polyedit. The command *Offsets & Intersections* requires pure polylines, not lines, to execute. So, since we had Line On with the last traverse, we have created a line. To use this in street design, we need to convert it into a polyline. Select *Polyedit* under the Edit pulldown menu.

Select polyline or [Multiple]: *Pick the side road line*
Object selected is not a polyline
Do you want to turn it into one? <Y> *press Enter*
Enter an option [Close/Join/Width/Edit vertex/Fit/Spline/Decurve/Ltype gen/Undo]: *press Enter*

10 Offsets & Intersections. Under the Area/Layout menu, select *Offsets & Intersections.*

Select all PRIMARY road polylines.
Select objects: *Enter*(we will consider both these subdivision streets secondary)
Select all SECONDARY road polylines.
Select objects: *Hold down the Shift key and pick the main centerline*
Select objects: *With shift key still down, pick the side road*
Select objects: *Enter* (for no more)



The street intersections are presented in a dynamic dialog as shown above. Try experimenting with different radii under the Secondary Roads column, then clicking Calculate. The streets will re-draw in the upper graphical area. But after experimenting, change the four values under Secondary Roads to those shown (ignore Primary Roads – those don't apply here), and click Calculate. Then click Finish 2D. Note the drawn-out street intersection.

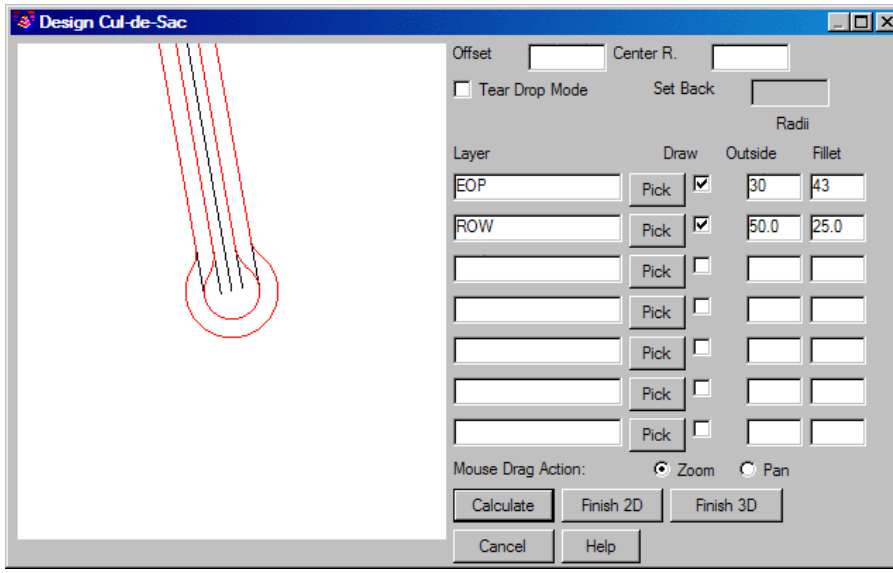
Now select *Layer ID* under the Inquiry menu. Pick on the outside polyline (it is layer ROW). Pick on the next polyline in from the outside (it is layer EOP). For example, if you had clicked off EOP under the Draw column in the above dialog, the edge-of-pavement polyline would not have drawn.

11

Standard Cul-de-Sac. Under Area/Layout, select Cul-de-Sacs. You may want to zoom into the area of the bottom center, near point 4. When finished with the procedure below, zoom back out.

Prompting:
Select all offset polylines to end with cul-de-sac.
Select objects: Do a crossing selection from right to left across the lower side road, selecting all 5 polylines (ROW-L, EOP-L, CL, EOP-R, ROW-R)
Select objects: *press Enter* (for no more)
Pick cul-de-sac center projection onto centerline: END (type end for endpoint snap)
Pick near the endpoint of the centerline of the lower side road near point 4. However make sure the pick is on the centerline polyline, or the routine will say the centerline not found.

This brings up the following dialog:

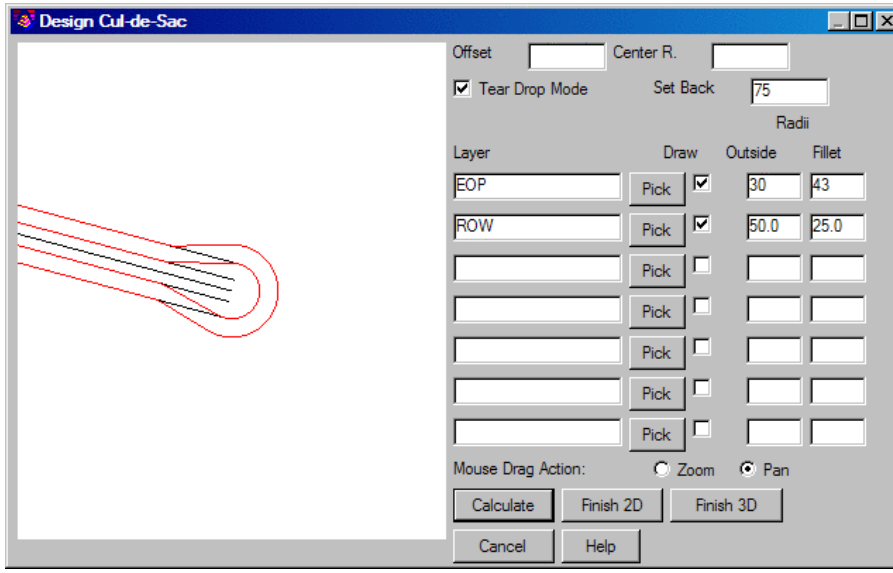


Again, you can change the Fillet Radius and the Outside Radius on the EOP or ROW, hit Calculate, and check out its effect. (Don't make the Outside radii too small or it will fail Calculate if there is no workable solution). Set values as shown above. Then click on Finish 2D.

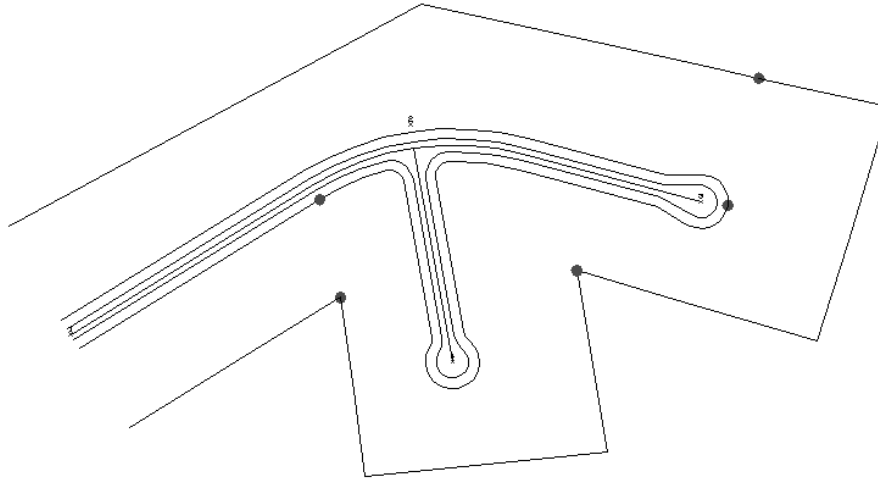
12 Teardrop Cul-de-Sac. Now select the *Cul-de-Sacs* routine again, under Area/Layout.

Select all offset polylines to end with cul-de-sac.
Select objects: *Do a crossing selection* pick from right to left across the right main road, selecting all 5 polylines (ROW-L, EOP-L, CL, EOP-R, ROW-R)
Select objects: *Enter*(for no more)
Pick cul-de-sac center projection onto centerline: END for endpoint snap *Pick endpoint of the centerline* of the lower side road near point 3

For a teardrop cul-de-sac, fill out the dialog as follows, then click on Calculate and Finish 2D.

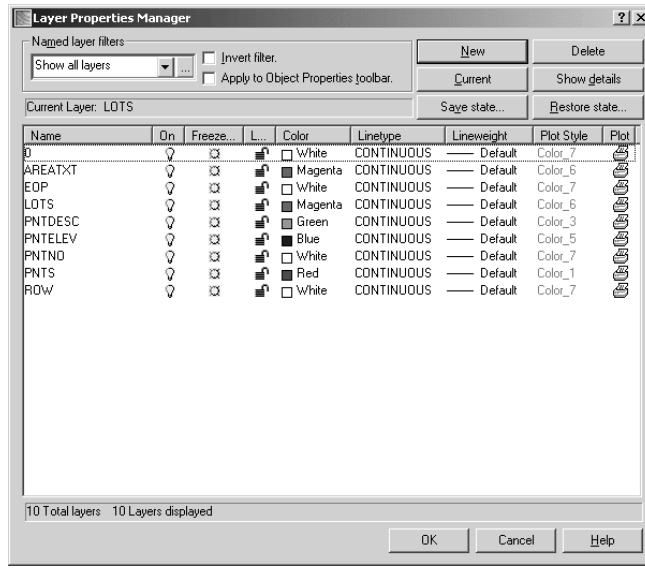


Teardrop cul-de-sacs allow moving vans and other large vehicles more turning room, and have been popular in the Cincinnati area, for instance. Our drawing now appears as shown below, with the exception of the filled reference dots.



13 Let's make a layer called LOTS using Layer Control found under View. It's a good idea to

create a layer and set it current before beginning the design process. Select Layer Control and obtain the following dialog:



Click on for New layer. When Layer1 highlights, as shown at bottom of list, type over it with LOTS, then click under the Color column and change the color to Magenta. Then click the (Set) Current button up top to make this layer current. Then click OK to exit the dialog.

Next, we will use *Break at Selected Point*, found in the Edit menu.

The *Lot Layout* routine under Area/Layout works nicely with reasonable polylines that run roughly parallel. Our goal is to make 1-acre lots. Lots of zigs, zags, and jogs in the polylines cause the perpendicular offset logic to fail to find a solution (lots will radiate perpendicular from the front polyline in Lot Layout). Not only should the front and back lines run opposite each other, but they should end at some point before the calculation runs into difficulty with impossible math.

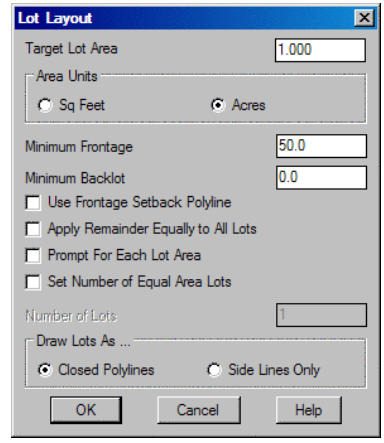
The outer R-O-W polyline currently runs left-to-right, goes around both cul-de-sacs and returns right-to-left in one, connected polyline. We need to break it near where the filled dot is pointing. It should be easy to lay out lots along the upper portion of the subdivision, as long as we stop to break the R-O-W polyline before it turns and runs back through the lower, more complex frontage and back property portions.

Under Edit, select *Break*, and slide over to *At Selected Point*. You will select using the filled dots, shown on the plan above, as references.

Select Line, Arc, or Polyline at break point: *Pick* near the filled dot on the outer boundary polyline.
Repeat the command for the ROW polyline.
Select Line, Arc, or Polyline at break point: *Pick* the far right end of the Teardrop cul-de-sac R-O-W polyline.

To prove you have broken the polylines in two, click on the R-O-W polyline on the south side (only the south portion should highlight), then click on the north R-O-W polyline (which we will use as our frontage polyline in the command Lot Layout). Then press the ESC key twice, which gets rid of the grips, as does zooming or panning.

14 Select Lot Layout under Area/Layout. A dialog appears:



Fill out as shown. In particular, click off Apply Remainder Equally to All Lots (if it is on) so that we force 1.000 acres lots and don't just get equal lots of some size such as 1.0017 (because the remainder lot that would not fit was added onto all lots).

Making Closed Polylines means that our side lines will be doubled up, each lot sharing a side line. Click OK.

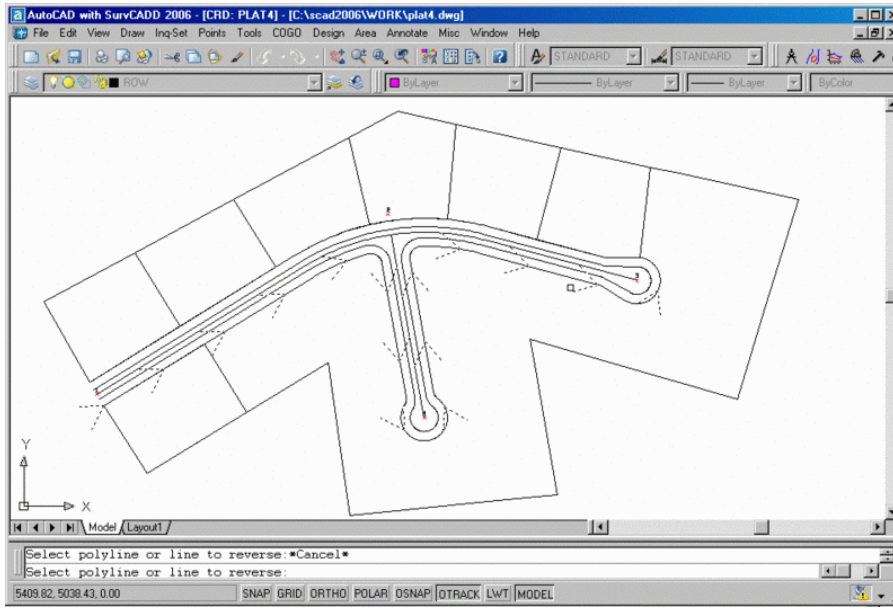
Select front polyline: *Pick north R-O-W*
Select back polyline: *Pick northernmost polyline the back property line.*

The 1.00 acres lots are laid out as far as is possible. You may get a small lot at the end of the row, which you would erase.

15 Applications of Reverse Polyline. We can get one more lots from Lot Layout, by doing the lower R-O-W at the left side of the drawing, and picking the southern back polyline. Let's try. Select *Lot Layout* under Area/Layout. Use same dialog entries. Select the front polyline as the southern edge of the road R-O-W, near the left side of the drawing. Select the back polyline as the southern property line. Oops! Nothing drew. It was unable to calculate. It turns out that the direction of the polyline is important. The southern R-O-W polyline starts way off to the right, so the program was not even considering where we were looking! We need to reverse the direction of the southern R-O-W polyline so it starts on the left side. Select *Reverse Polyline*, found under the Edit pulldown, sliding over from *Polyline Utilities*. It prompts:

Select polyline or line to reverse: *Pick the southern R-O-W polyline.*

The polyline now reverses direction, goes left-to-right, and shows phantom direction lines (which are automatically removed when the command ends). Now repeat the Lot Layout command as outlined in the beginning of Step 15, and we get one new lot out of the exercise, as shown below. If you get a second wedge shaped lot, erase it.


AutoCAD with SurvCADD 2006 - [CRD: PLAT4] - [C:\scad2006\WORK\plat4.dwg]
File Edit View Draw Ing-Set Points Tools COGO Design Area Annotate Misc Window Help
Model Layout1
Select polyline or line to reverse: *Cancel*
Select polyline or line to reverse:
5409.82, 5038.43, 0.00
SNAP GRID ORTHO POLAR OSNAP OTRACK LWT MODEL

16 Break at Intersection. The lower back property line is still continuous. We can work with it in small pieces rather than as one big polyline. Say we want to break it as the inside corner identified by the arrow above. To do this, select Edit pulldown, Break, sliding over to At Intersection. Prompting:

Select Line, Arc, or Polyline to Break: *Pick the south property line*
[app on] Pick Intersection to break at: Move the cursor to the intersection point indicated above, look for the INT snap to appear as you approach the exact corner (which is an intersect), then click there.

17 Draw a Polyline from the corner indicated by the filled dot to the beginning of the R-O-W arc, also indicated by a filled dot in the previous graphic. Select 2D Polyline under Draw.

Pick point or point numbers: End (type in end for the endpoint snap)
of ..Pick the inner back property corner
Undo/Arc/Length/<Pick point or point numbers>: End (type in end for the endpoint snap)
of ..Pick the beginning of the Arc (it will show endpt when you get close to the true start of arc)
Undo/+/-/Arc/Close/Length/<Pick point or point numbers>: Enter (to end)

18 Area by Interior Point. We have just created a new lot, but the lot is not defined by one, single, closed polyline. If we want to verify its area, however, we can still use the command Area by Interior Point. Select Area by Interior Point under Area.

Pick point inside area perimeter: *Pick inside our new lot*

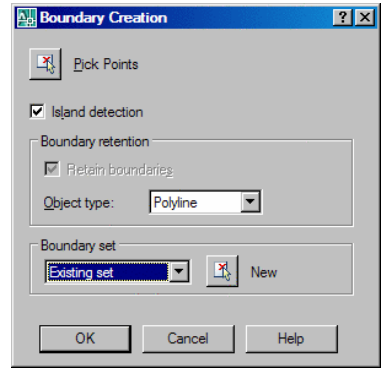
SQ. FEET: 40997.2 SQ. YARDS: 4555.2 SQ. MILES: 0.0

ACRES: 0.9412 PERIMETER: 830.5026

Pick area label centering point: *Press Enter*here to avoid labeling.

The lot is less than one acres. We will set as a goal to extend its lower boundary to the right to obtain one acre. That is accomplished by using the command Hinged Area. But Hinged Area works best if we have a nice, closed polyline for the new lot. We can get one using the command Boundary Polyline.

19 Boundary Polyline. At the command line, type in BPOLY (or BOUNDARY). When the dialog appears, pick New.

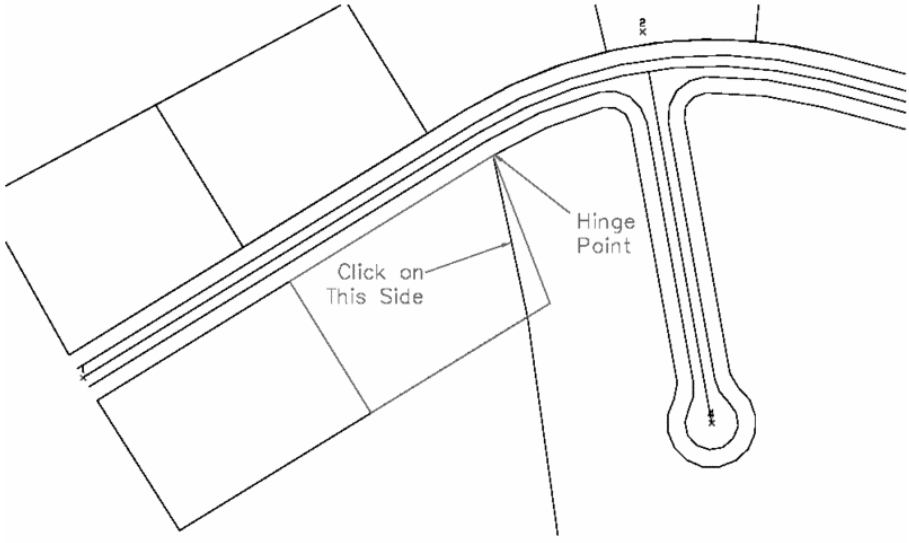


Then pick all the polylines that surround our new lot. Then after you hit Enter to Select objects, this same dialog returns. Then you select Pick Points and pick inside the lot. This creates a new closed polyline, in the current, LOTS layer (magenta).

20 Select *Hinged Area* under the Area/Layout pulldown.

Define area by points or closed polyline [Points/<Linework>]? *press Enter* (for linework)
Select polyline segment to adjust: *Pick on the right-side line*
Select hinge point [endp]: *Pick on the upper right hinge point* (see arrow)
Keep existing polyline [Yes/<No>]? N
Area: 40997.20 S.F, 0.9412 Acres
Remainder/Acres/<Enter target area (s.f.)>: A (for acres)
Remainder/SF/<Enter target area (acres)>: 1.0

The new lot draws, as shown below:



21 Next, use the Erase command to remove the segment that is pointed to above with the text Click on This Side.

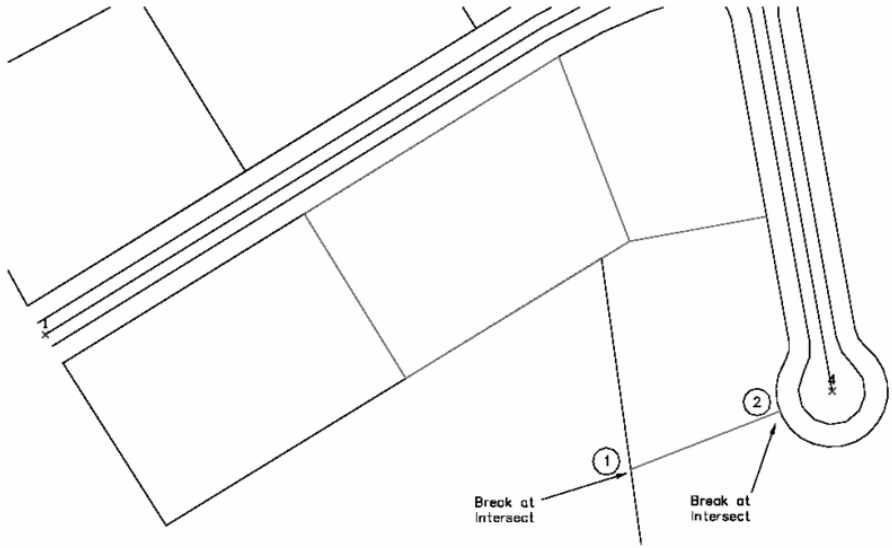
22 Make 2 More Lots with Polyline command. Instead of using Draw, *2D Polyline*, we will use the straight AutoCAD polyline command. At the command line, enter PL.

Specify start point: END (type in the endpoint snap)
of Pick the endpoint (which is the lower right corner of the new lot).
Current line-width is 0.00
Specify next point or [Arc/Halfwidth/Length/Undo/Width]: PER(type in the perpendicular snap)
to Pick on the R-O-W polyline to the right.
Specify next point or [Arc/Close/Halfwidth/Length/Undo/Width]: *press Enter*(to end)

Now for the second lot. Referring to the drawing below, repeat the PL command, and answer as follows:

Specify start point: NEA (enter the nearest snap)
of Pick on the property line anywhere near the circled point 1(no need to be exact)
Current line-width is 0.00
Specify next point or [Arc/Halfwidth/Length/Undo/Width]: PER (type in the perpendicular snap, which when intersecting arcs means radial to the arc)
to Pick on the R-O-W polyline near circled point 2.
Specify next point or [Arc/Close/Halfwidth/Length/Undo/Width]: *ENTER* (to end)

The drawing appears below:



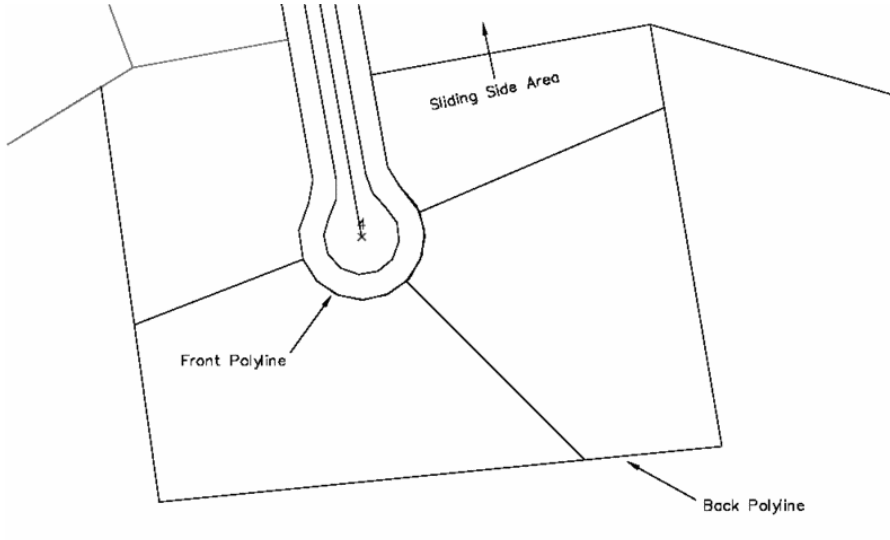
23 Issue the *Break at Intersect* command, and break the back property polyline and the cul-de-sac R-O-W polyline at the intersections with our newly drawn polyline from step 22. Repeat this command, and break the back property polyline at the filled dot to the right of the "Sliding Side

Area" label below.

24 Repeat *Lot Layout* with the same entries as before. The front and back polylines to select are shown below, along with the results. This gives us 2 more usable lots.

Next, use the *2D Polyline* command to generate a segment (above the "Sliding Side Area" label below) that runs from the ENDpoint of the corner to a point PERpendicular to the R-O-W line. Then use BPOLY to create a closed boundary inside it.

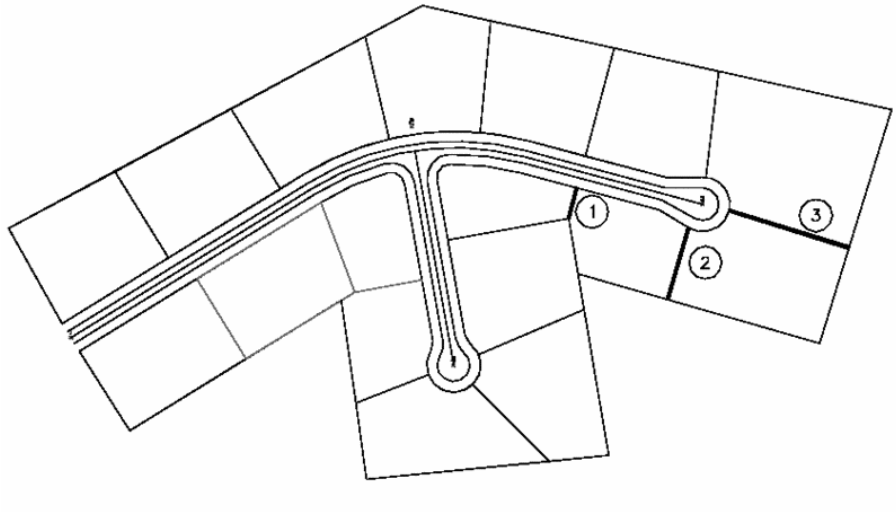
Erasing the original segment you placed is a little tricky since the newly formed polyline is on top. When two pieces of geometry lie on top of each other, Carlson will take the one created last. Issue the *Erase* command, then hold down the control key while picking the segment above the "Sliding Side Area" label. When the single segment highlights, press enter to erase it, leaving the boundary polyline.



25 Sliding Side Area. Because we have a small closed polyline, we can investigate another area command, the Sliding Side Area. As shown in the graphic above, we want to slide the north side of the last, smaller lot parallel to its current bearing such that the lot will contain 1.00 acres. Select *Sliding Side Area* under the Area/Layout pulldown.

Define area by points or closed polyline [Points/<Linework>]? *press ENTER*
Select polyline segment to adjust: Pick the north side of the lot above (shown here containing the words Sliding Side Area)
Keep existing polyline [Yes/<No>]? *press ENTER*
Area: 20375.30 S.F, 0.4678 Acres

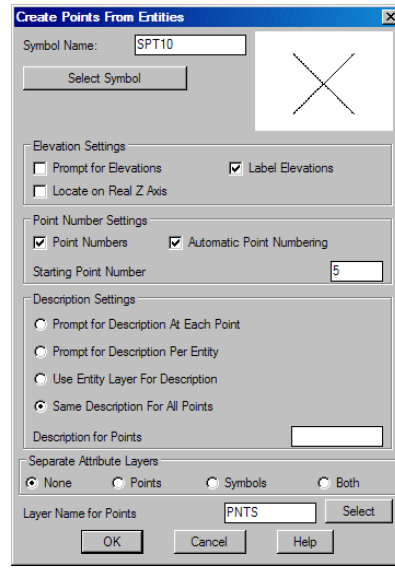
Remainder/Acres/<Enter target area (s.f.)>: A (a for acres)
Remainder/SF/<Enter target area (acres)>: 1.0



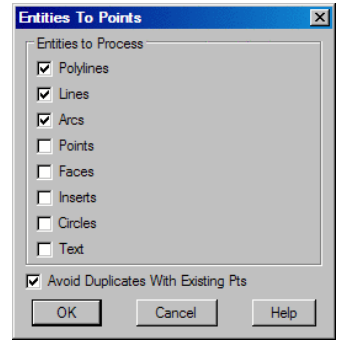
26 Complete the remaining Lots. Using the *2D Polyline* command, under Draw, use endpoint snaps and perpendicular snaps (end and per) to draw the final 3 polylines, shown below marked 1, 2 and 3 for reference.

It may not be the most aesthetic subdivision, but we applied a lot of tools making it. But we're not done. There's some real automation ahead.

27 Create Points from Entities. We have designed a subdivision, in effect, without point numbers. This is the beauty of CAD. But we need to make point numbers in order to stakeout the subdivision. To do this, select *Create Points from Entities*, under COGO. The following dialog appears:

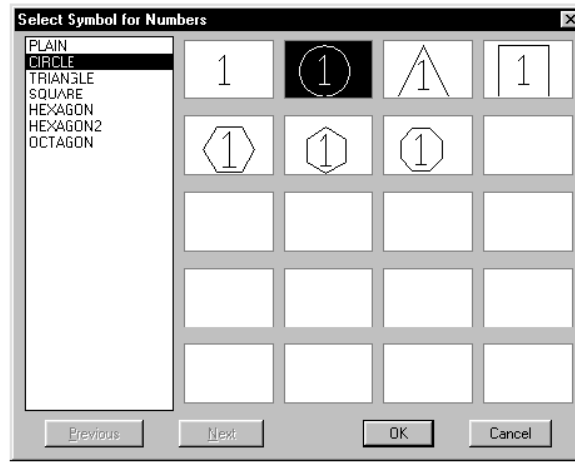


Set the starting point number to 5, verify the dialog as shown, and click OK. A second dialog, covering what entities to capture, appears next. Stick with the default settings and click OK.

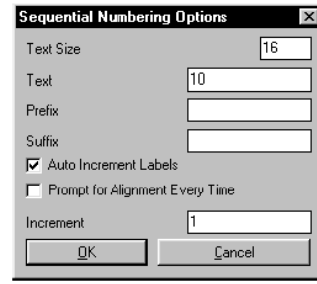


When it asks, Select objects, type in All. Press Enter for no more selections, and Enter again. All the point numbers for stakeout are created.

28 Number the lots, clockwise from the upper left, using the command *Sequential Numbers*. Under Draw, select *Sequential Numbers*. This dialog appears:



Choose the circled text and click OK.



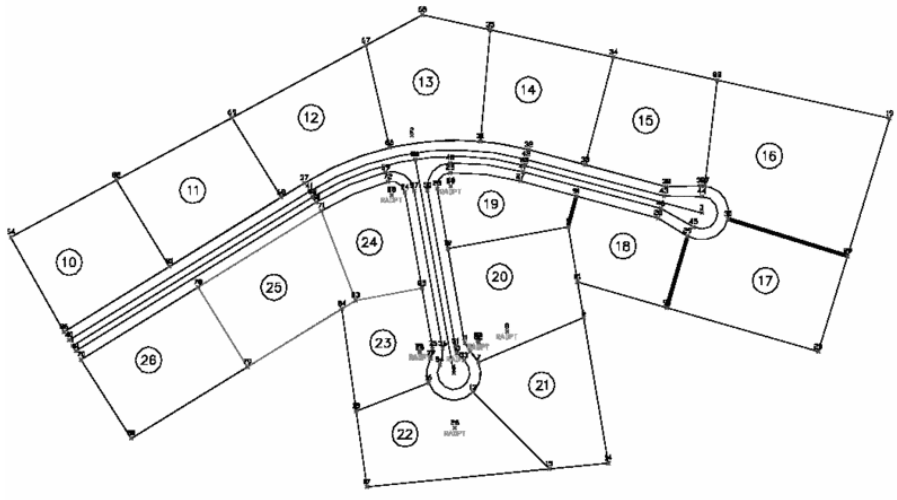
Set the text size (height) to **16** and the starting text value to **10**, as shown. Then click OK.

Pick point at center of label or type Polylines to label: *Pick near the center of the first upper left lot.*
Pick point for label alignment: *Press F8* for <Ortho on> Pick to the right.

Now pick near the center of all of the lots, going clockwise.

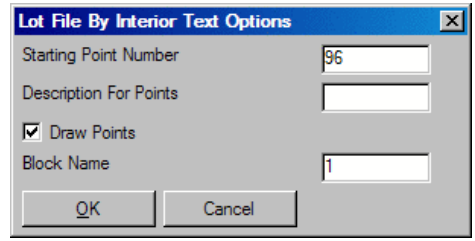
When done, and back to the command line, press F8 again to set Ortho off.

The resulting drawing, with point numbers, is shown below:



29 Lot File by Interior Text. Official lot files can be created whenever a lot number or name exists within a lot as the sole text (other text may be present but could be frozen). So we will play it safe and first freeze the point number layer. Before we do, take note of the point number assigned to the NW corner of Lot 10. In our case, it is point 64 (it may be different in your case, depending on how you selected the objects in the command Convert Entities to Points).

Under View, select *Freeze Layer* and pick on one of the point numbers. Now go to the Area/Layout pulldown, select *Create Lots* and slide over to select *Lot File by Interior Text*.



A dialog box will appear. Be sure that is says Block Name 1. Click OK.

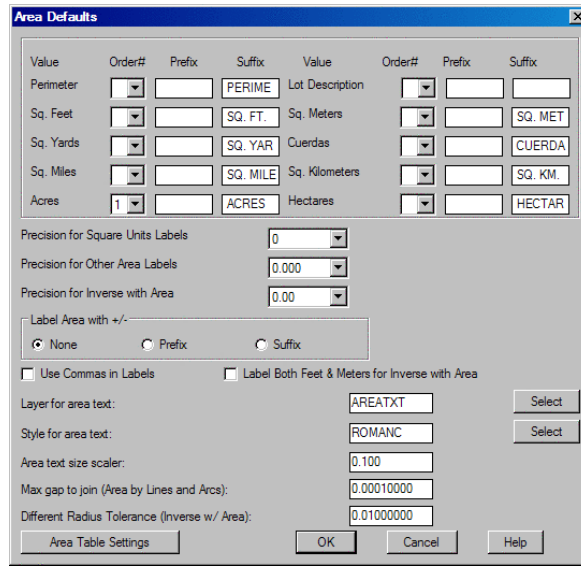
Select lot lines, polylines and text.
Select objects: *Pick the lots and the lot numbers*

The Lot Files will be created. Before we look at the Lot Files, let's finish up and do area annotation

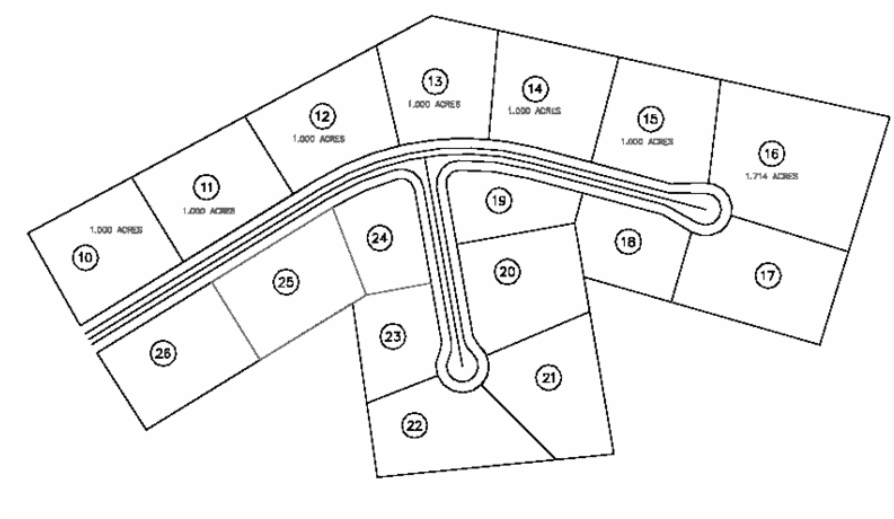
on the upper lots, by the command *Area by Interior Point*.

Note: If we had not made points at all lot corners, using Convert Entities to Points, the Lot File by Interior Text would make point numbers. This is the reason for the prompt: Starting point number. If points are found, no new ones are created. Lot files must have points at all the corners.

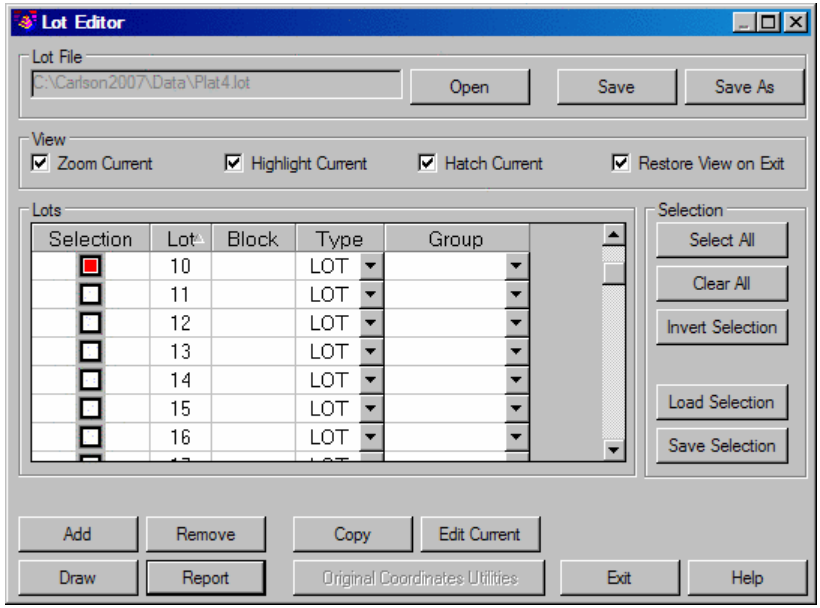
30 Area by Interior Point. Select *Area Defaults*, under Area/Layout, and cancel the square feet plot, leaving only the area plot to 3 decimal places. Set as shown below:



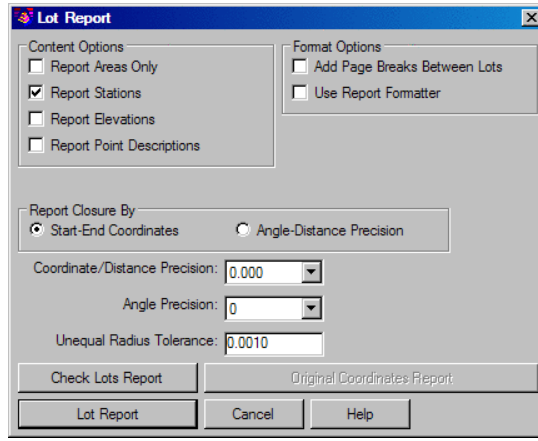
Now choose *Area by Interior Point*, under the Area/Layout pulldown menu, and pick inside Lots 10 through 16, as shown below:



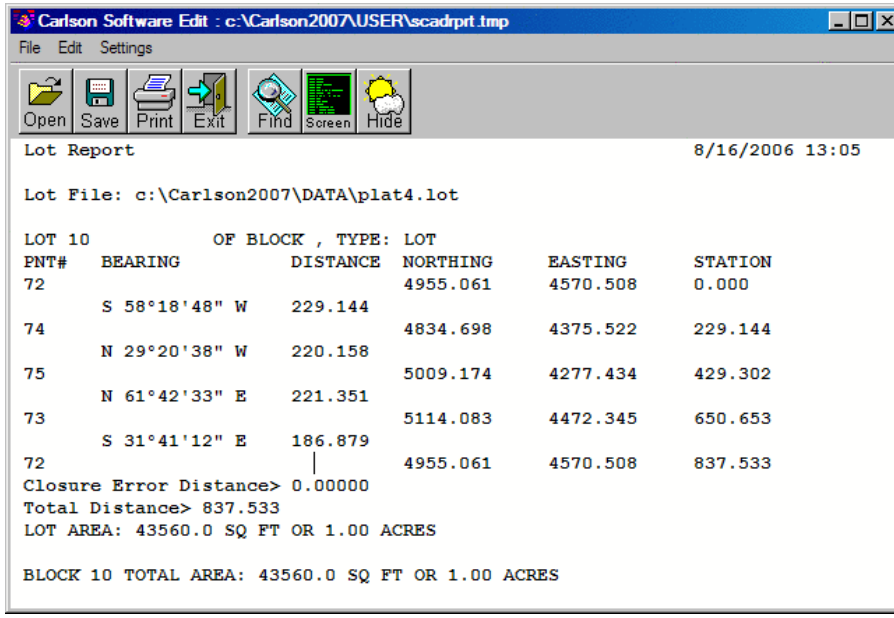
31 Select *Lot Manager*, under Area/Layout, and the following Lot Editor dialog appears:



Pick on Lot 10 and click Report. This will lead to the Lot Report dialog box.



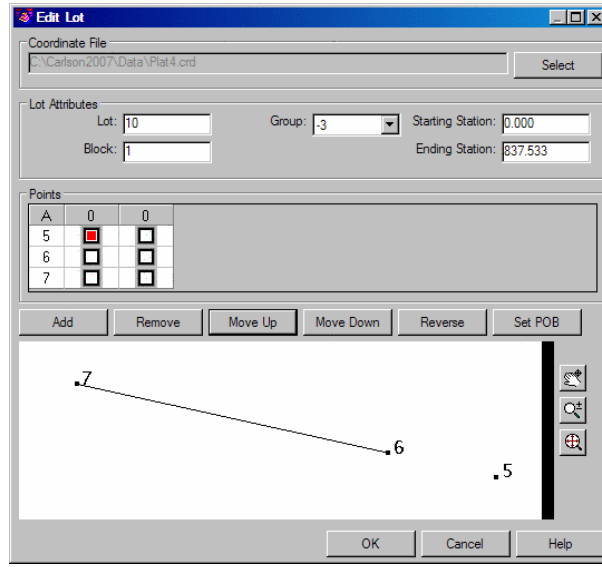
Be sure that your setting are as shown above, and then click Lot Report.


Carlson Software Edit : c:\Carlson2007\USER\scadrprt.tmp
File Edit Settings
Open Save Print Exit Find Screen Hide
Lot Report 8/16/2006 13:05
Lot File: c:\Carlson2007\DATA\plat4.lot
LOT 10 OF BLOCK , TYPE: LOT
PNT# BEARING DISTANCE NORTHING EASTING STATION
72 4955.061 4570.508 0.000
S 58°18'48" W 229.144
74 4834.698 4375.522 229.144
N 29°20'38" W 220.158
75 5009.174 4277.434 429.302
N 61°42'33" E 221.351
73 5114.083 4472.345 650.653
S 31°41'12" E 186.879
72 4955.061 4570.508 837.533
Closure Error Distance> 0.00000
Total Distance> 837.533
LOT AREA: 43560.0 SQ FT OR 1.00 ACRES
BLOCK 10 TOTAL AREA: 43560.0 SQ FT OR 1.00 ACRES

This dialog is typical of the many Carlson Standard Report Viewer dialogs, first introduced in Carlson CES. You can click on 1 or more lines, highlight them and hit the delete key on the keyboard, and these lines will delete. You can edit lines directly in the dialog. You can also save the report to disk with the Save icon shown above. To exit, click the Exit icon.

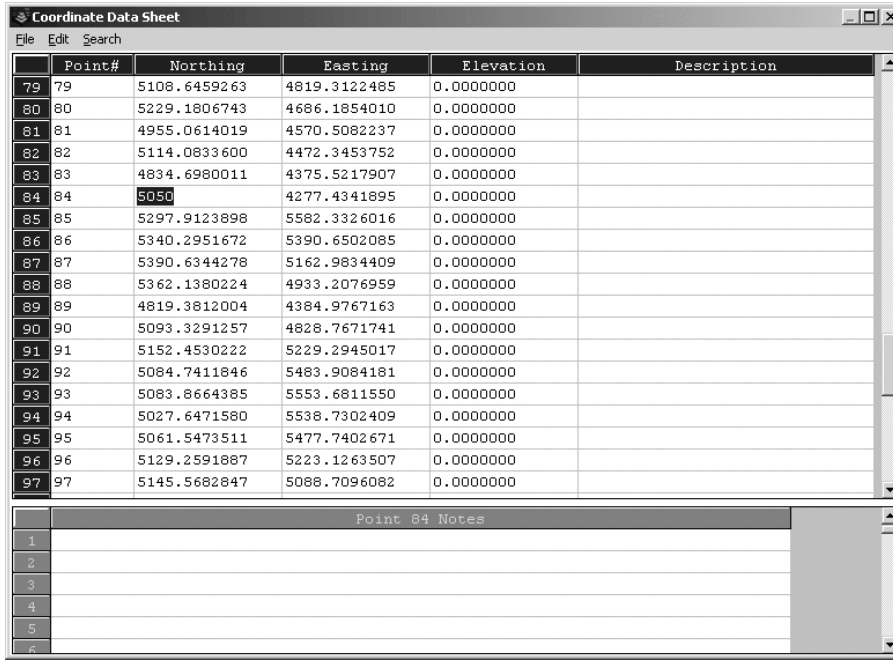
32 The Edit Current (lot) option within the Lot Editor dialog box can be used to describe a lot by different point numbers, or to assign a lot to a different block. This is explained here and shown below for reference purposes only.

Click *Lot Manager* under the Area/Layout pulldown menu. You will see the Lot Editor dialog as shown in Step 31. First, make sure that a .lot file is open. If it is not, open one. Then, under Selection, select a lot to edit. Click Edit Current. You will get this dialog. Note the graphic display in the lower half, which map the Points listed above.



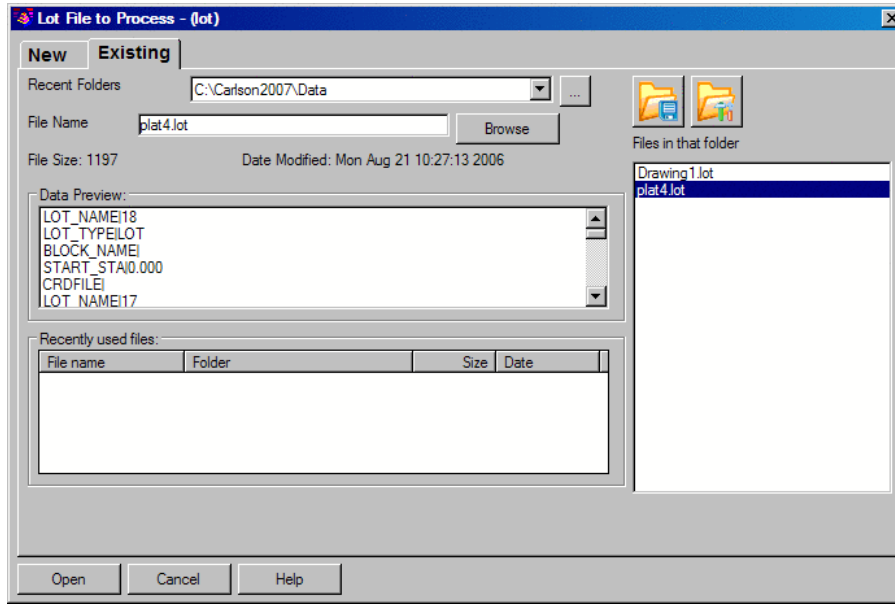
33 Re-Drawing Lots after Editing Points. Let's assume you actually changed the point numbers that define Lot 10. That would cause the lot to draw differently. Also, you could simply alter the coordinate values of a point in the current lot file. That would also cause the lot to draw

differently. Let's take the latter approach. Remember point 64? It is the NW corner of lot 10 (in our case your's may be different as stated above). So select *Edit Points* under the Points pulldown menu. A spreadsheet appears. Scroll down to point 64 (or whatever point is your NW corner of Lot 10).

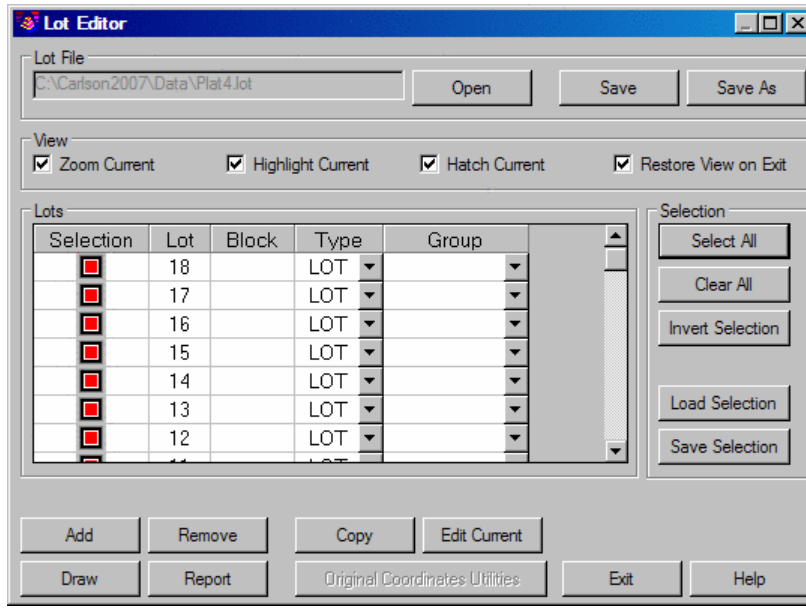


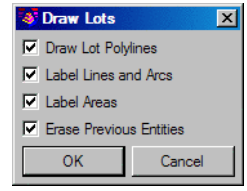
Click on the Northing and edit it to 5050. This is for illustration purposes. In reality, you might be fine-tuning your subdivision design points. As long as the same points define the lots, you are, in effect, making a ready-made new drawing. Now select at the top of the dialog File, then *Save and Exit*.

34 Draw the Lot File. Before we draw the lot file, save your drawing by selecting *Save* under the File pulldown menu. Then choose *New*, exit the Startup Wizard (if it appears), and go straight to *Lot Manager*, found under the Area/Layout pulldown menu. *Lot Manager* provides the tools for drawing lot files to the screen.

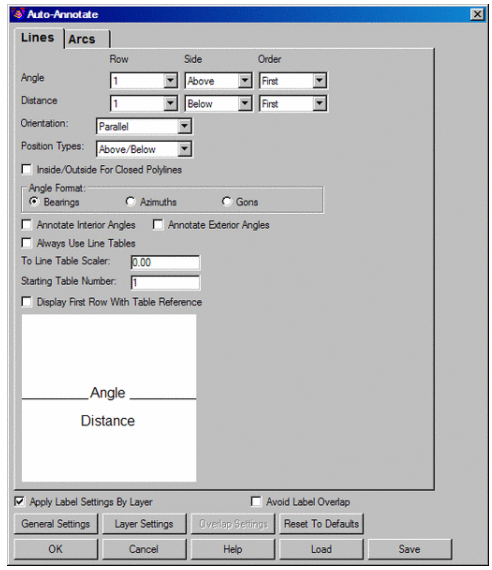


Click the Existing tab. Select the plat4 lot file and click Open. Now select your existing crd file that you created earlier. In the next dialog, called Lot Editor, shown below, choose all lots by clicking Select All. Then click Draw.

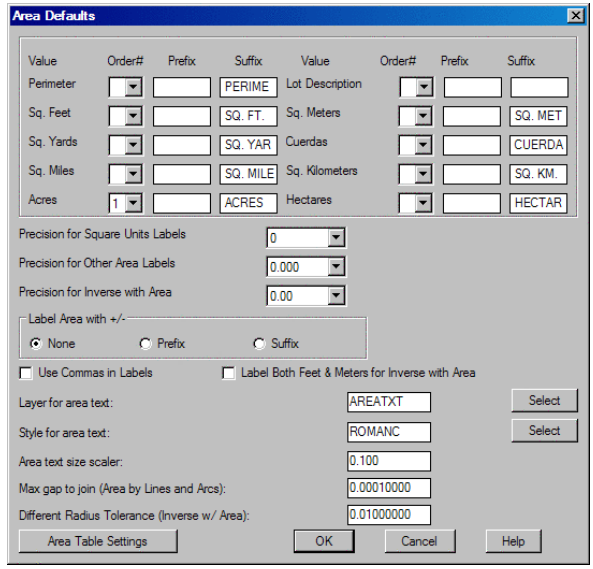




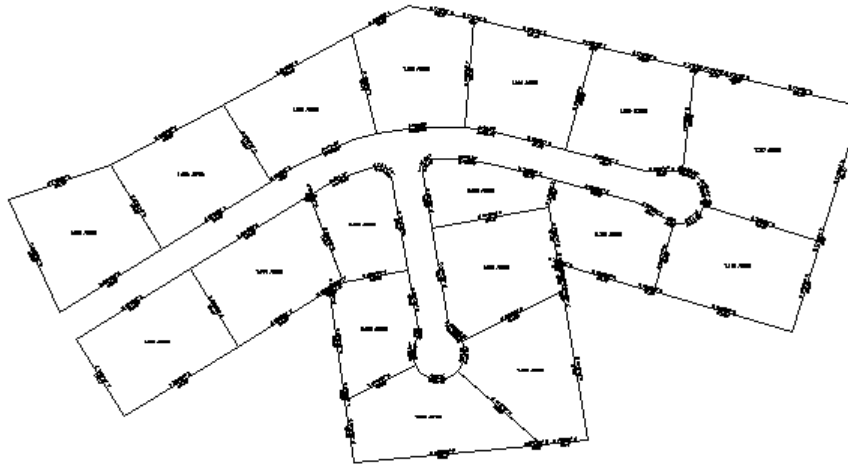
Accept the defaults and click OK to the Draw Lots dialog box. This leads to the Auto-Annotate dialog, shown below. Use the settings shown here. Click OK.



Next comes the Area Defaults dialog, as seen in Step 30. Fill out exactly as shown in Step 30.



Click OK and then Exit. This leads to the plot shown below, created entirely from stored Lot Files, and showing our revision of Lot 10.



This completes this Lesson 4 tutorial titled Intersections and Subdivisions.

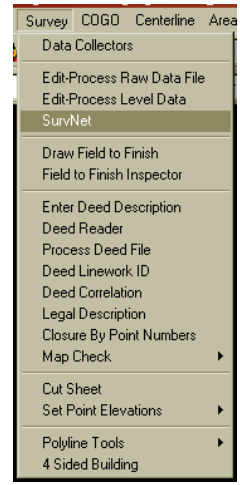
Lesson 5: SurvNET

This tutorial is divided into two lessons covering the process of reducing and adjusting raw survey data into final adjusted coordinates, using the SurvNET program. The tutorial will describe the reviewing and editing of the raw data prior to the processing of the raw data. Next, the least squares project settings will be described, and then the final report generated from the least squares processing will be be reviewed. This tutorial will review both a total station only project, and a project that combines both total station and GPS vectors.

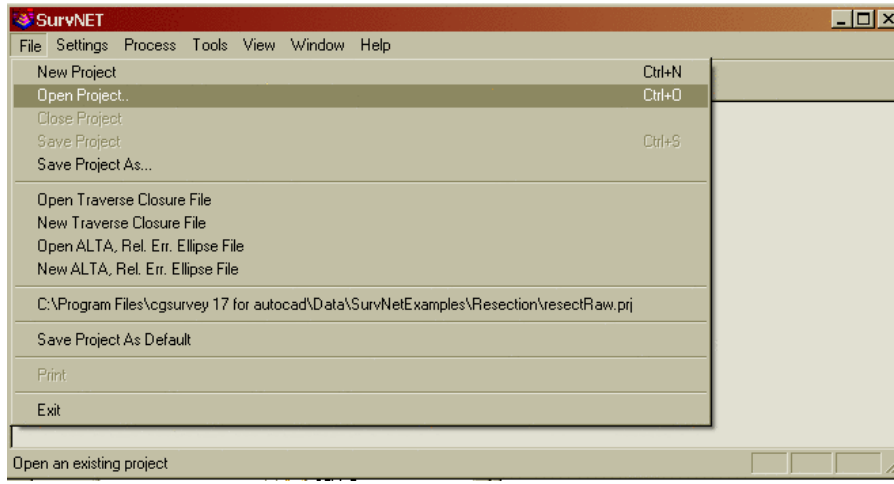
The raw data files associated with this tutorial is located in the Carlson2007\Data folder, under the installation folder on your computer (example: \Carlson2007\DATA).

Lesson One - Processing an Assumed Coordinate System 2D Total Station Network

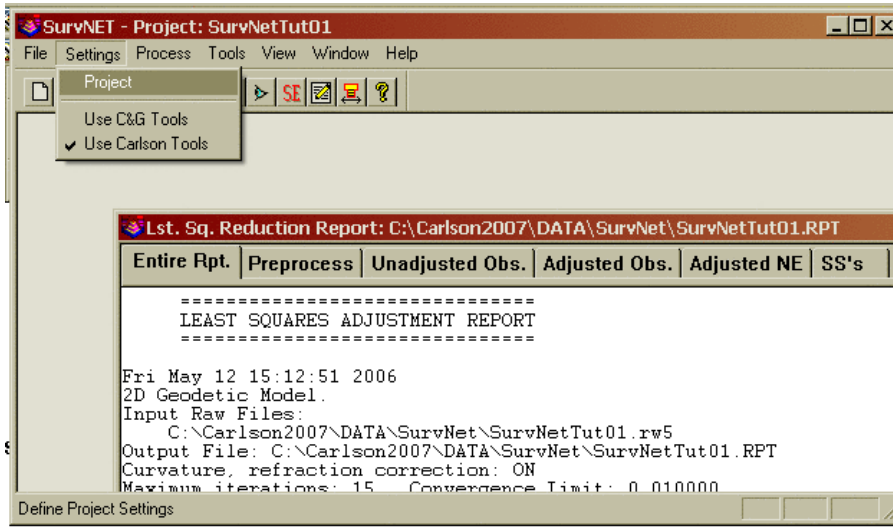
1 The easiest way to start the program is to select *SurvNET* from the Survey menu. This opens the SurvNET window and program.



2 The first step is to open an existing project or create a new project. We will open an existing project. Choose *Open Project* from the File menu. Navigate to the \Carlson2007\DATA\ folder and open the SurvNetTut01 project.

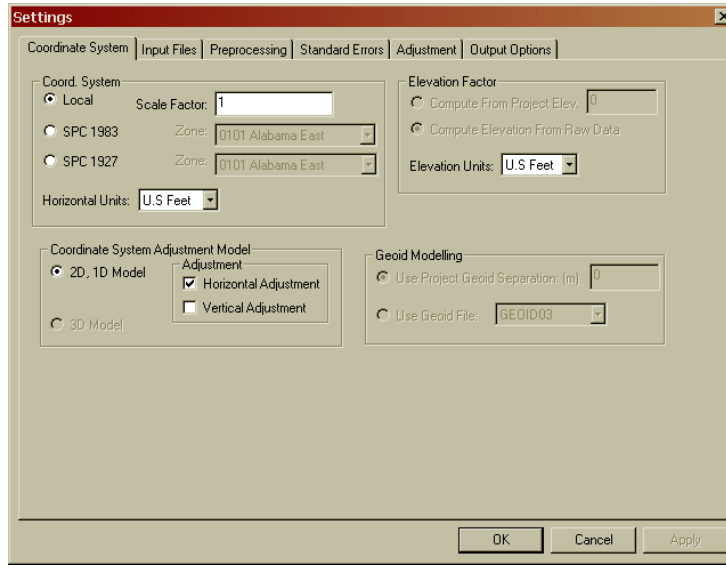


3 Learning the meaning and implications of the different project settings is the most critical initial step in learning how to use SurvNET. Let's review the different project screens. Choose *Project* from the Settings menu.



Least Squares Settings

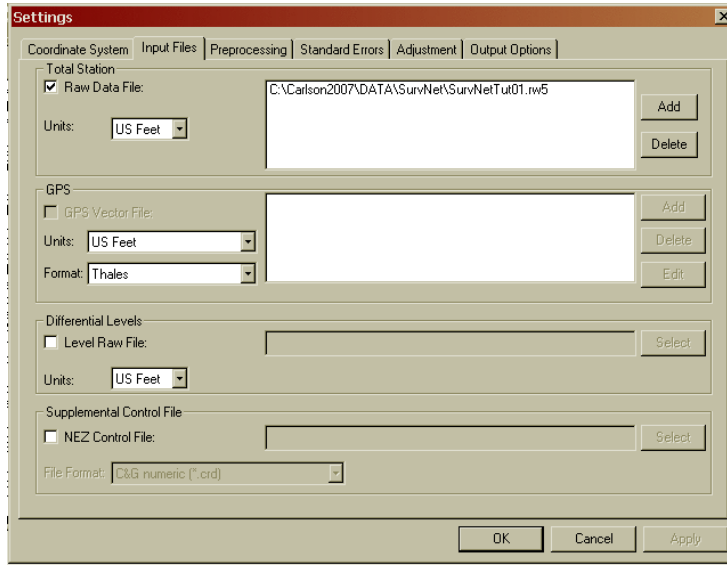
4 The Network Least-Squares Settings dialog box is displayed. In this dialog, the different settings required for the Least Squares reduction are available in the different tabbed dialog boxes. When all of the settings are set as desired, press OK to save the changes to the project settings, or press Cancel to return to the raw data editor without saving any project settings. For the purpose of this tutorial, the Coordinate System settings tab should look as follows before proceeding to the next step. To use an assumed coordinate system, the 'Local' Coord. System needs to be checked, and the 2D,1D Adjustment Model must be chosen. When using a local coordinate system, the distance units are not important other than for display purposes in the report. Computing elevation factors and performing Geoid modeling is not applicable to assumed datums. Notice that in this example we are not performing a vertical adjustment.



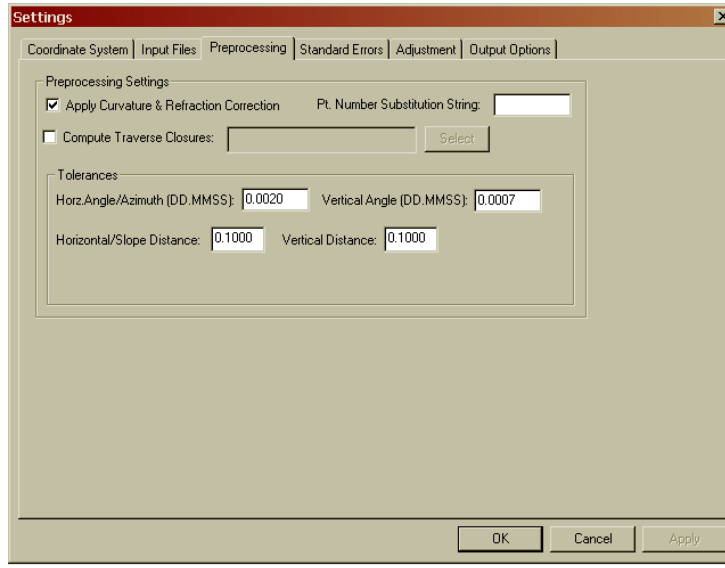
For more information on the content of this dialog box section, please review the SurvNET chapter of this manual.

5 Choose the 'Input Files' tab. This is the section of the Settings dialog box where you define the data files that make up the project. You can have multiple raw files in a single project. The ability for multiple raw files allows flexibility in collecting the data and processing large projects. It is typically easier in a large project to analyze and edit subsets of the total project, before combining all the data for a final adjustment. Notice that since we are working in a local coordinate system and using the 2D,1D Adjustment Model, GPS vectors cannot be incorporated into this project.

Note: The sample tutorial project has the input raw file in the default data folder of C:\Carlson2007\DATA. If you have a different data directory, then set the correct data file by highlighting the default file, pick Delete and then pick Add and select SurvNetTut01.rw5 from your data folder.

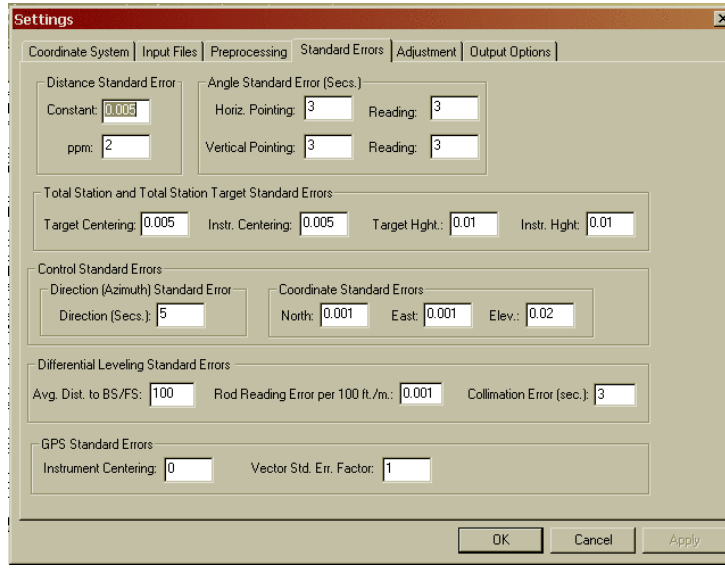


6 Choose the Preprocessing tab to review the least squares preprocessing settings. For the purpose of this tutorial, the Preprocessing settings should look as follows before proceeding to the next step. Preprocessing consists of reducing and averaging all the multiple measurements, applying curvature and refraction correction, reducing the measurements to grid if appropriate, and computing unadjusted traverse closures if appropriate. Much of the data validation is performed during the preprocessing step.



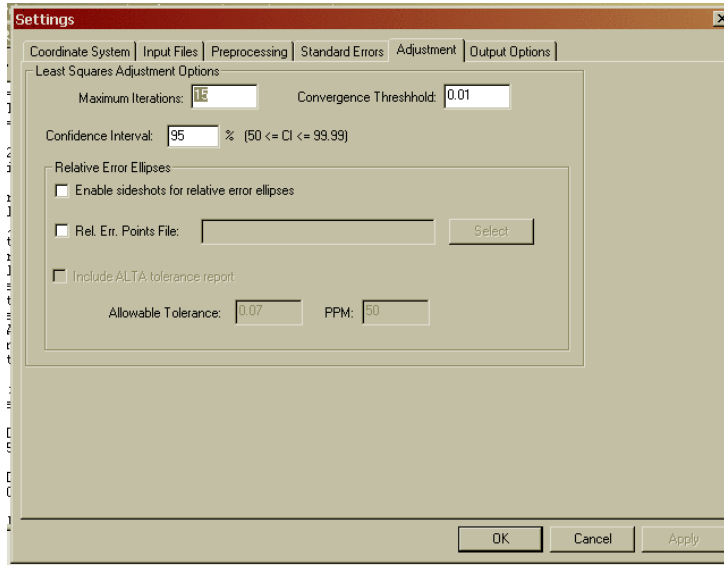
For more information on the content of this dialog box section, please review the SurvNET chapter of this manual.

7 Choose the Standard Errors tab to review the standard error settings. The standard error settings should look as follows before proceeding to the next step. Standard errors are an estimate of the different errors you would expect to obtain based on the type equipment and field procedures you used to collect the raw data. For example, if you are using a 5 second theodolite, you could expect the angles to be measured within +/- 5 seconds (Reading error).

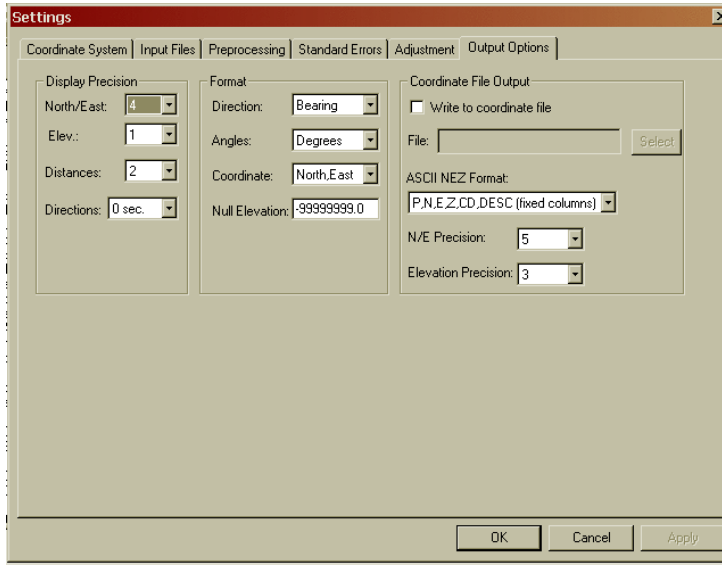


For more information on the content of this dialog box, please review the SurvNET chapter of this manual.

8 Choose the Adjustment tab to review the Adjustment settings. The Adjustment settings should look as follows before proceeding to the next step. The Adjustment settings affect how the actual least squares portion of the processing is performed. Additionally, from the screen the user can set whether ALTA reporting is performed.



9 Choose the Output Options tab to review the output settings. For the purpose of this tutorial, the Output Options settings should look as follows before proceeding to the next step. These settings apply only to the output of data to the report files. These settings do not affect computational precision. Press OK to return to the main SurvNET screen.



General Rules For Collecting Data for Use in Least Squares Adjustments

Least squares is very flexible in terms of how the survey data needs to be collected. Generally speaking, any combination of angles and distances, combined with a minimal amount of control points and azimuths, are needed. This data can be collected in any order. But there needs to be at least some redundancy in the measurements.

Redundant measurements are measurements that are in excess of the minimum number needed to determine the unknown coordinates. Redundancy can be created by including multiple GPS, and other control points, within a network or traverse. Measuring angles and distances to points in the network that have already been located create redundancy. Running additional cut-off traverses, or additional traverses to existing control points, creates redundancy. Following are some general rules and tips in collecting data for least squares reduction.

- Backsights should be to point numbers. Some data collectors allow the user to backsight an azimuth not associated with a point number. SurvNET requires that all backsights be associated with a point number.

- There has to be at least a minimum amount of control. There has to be least one control point. Additionally, there needs to be either one additional control point or a reference azimuth. Control points can be entered in either the raw data file, or there can be a supplemental control point file containing the control point. Reference azimuths are entered in the raw data file. The control points and azimuths do not need to be for the first points in the raw file. The control points and azimuths can be associated with any point in the network or traverse. The control does not need to be adjacent to each othere. It is permissible to have one control point on one side of the project, and a reference azimuth on the other side of the project.

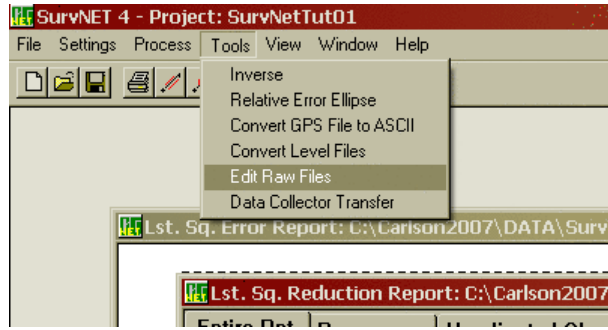
- At least one of the control points needs to be occupied. There may be situations where no control point is ever occupied in the network, but only backsighted. In these situations, a preliminary value for one of the occupied points needs to be computed and entered as a floating point control point.

- Some data collectors do not allow the surveyor to shoot the same point twice using the same point number. SurvNET requires that all measurements to the same point use a single point number. The raw data may need to be edited after it has been downloaded to the office computer to insure that points are numbered correctly.

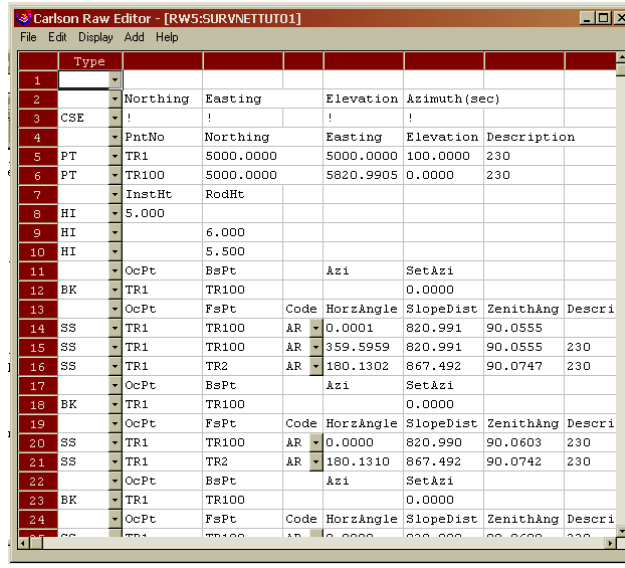
- The majority of all problems in processing raw data are related to point number problems. Using the same point number twice to different points, not using the same point number when shooting the same point, misnumbering backsights or foresights, and misnumbering control points are all common problems.
- It is always best to explicitly define the control for the project. A good method is to put all the control for a project into a separate raw file. A big source of problems with new users is a misunderstanding in defining their control for a project.
- Some data collectors may have preliminary unadjusted coordinates included with the raw data. These coordinate records should be removed from the raw file. The only coordinate values that should be in the raw file are the control points.
- When a large project is not processing correctly, it is often useful to divide the project into several raw data files and debug and process each file separately as it is easier to debug small projects. Once the smaller projects are processing separately, they can be combined for a final combined adjustment.

Reviewing and Editing the Raw data

10 To review or edit the raw data, choose the *Edit Raw Files* command from the Tools menu.


SurvNET 4 - Project: SurvNetTut01
File Settings Process Tools View Window Help
Inverse
Relative Error Ellipse
Convert GPS File to ASCII
Convert Level Files
Edit Raw Files
Data Collector Transfer
Lst. Sq. Error Report: C:\Carlson2007\DATA\SurvN
Lst. Sq. Reduction Report: C:\Carlson2007\

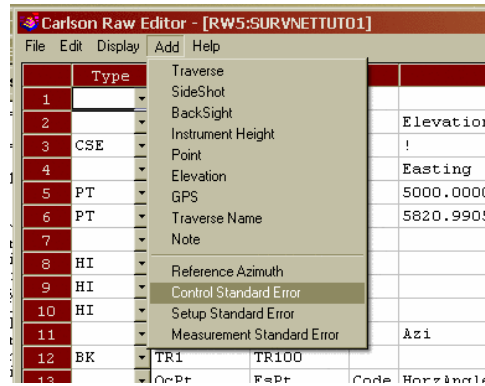
11 If there are problems with the raw data, such as point numbering problems or incorrect rod heights, the raw data can be edited from this dialog. See the section on the raw data editor in the Carlson documentation to learn the details of the editor. Review the following Standard Errors and Control Points section before exiting the raw data editor.



	Type							
1								
2		Northing	Easting		Elevation	Azimuth(sec)		
3	CSE	!	!		!	!		
4		PntNo	Northing		Easting	Elevation	Description	
5	PT	TR1	5000.0000		5000.0000	100.0000	230	
6	PT	TR100	5000.0000		5820.9905	0.0000	230	
7		InstHt	RodHt					
8	HI	5.000						
9	HI		6.000					
10	HI		5.500					
11		OcPt	BsPt		Azi	SetAzi		
12	BK	TR1	TR100			0.0000		
13		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Descri
14	SS	TR1	TR100	AR	0.0001	820.991	90.0555	
15	SS	TR1	TR100	AR	359.5959	820.991	90.0555	230
16	SS	TR1	TR2	AR	180.1302	867.492	90.0747	230
17		OcPt	BsPt		Azi	SetAzi		
18	BK	TR1	TR100			0.0000		
19		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Descri
20	SS	TR1	TR100	AR	0.0000	820.990	90.0603	230
21	SS	TR1	TR2	AR	180.1310	867.492	90.0742	230
22		OcPt	BsPt		Azi	SetAzi		
23	BK	TR1	TR100			0.0000		
24		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Descri

Standard Errors and Control Points

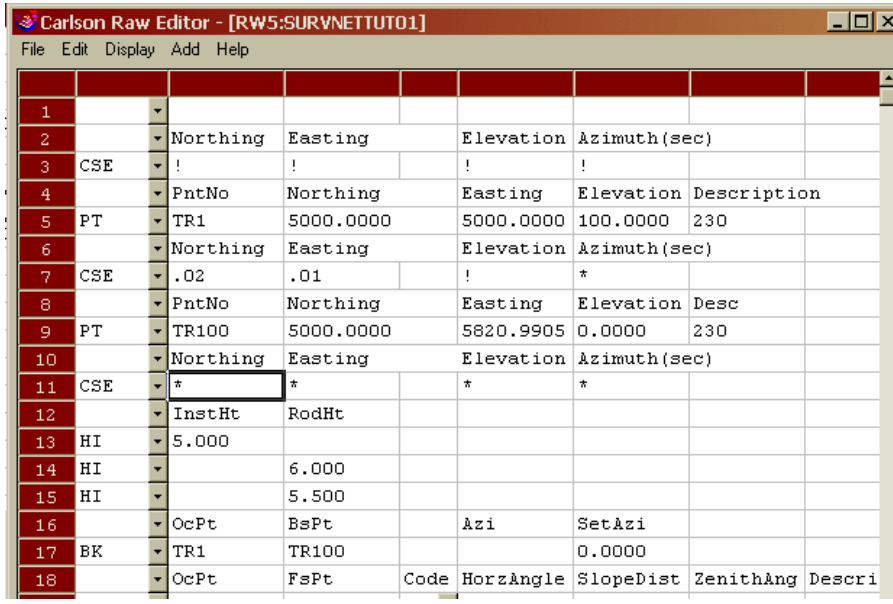
The default standard errors for points are defined in the Standard Errors sheet of the Settings dialog box. There are times when the default values may need to be overridden. For example, the control may be from GPS and the user has differing standard errors for his various GPS points. Or maybe some of the control points were collected with RTK methods, and other GPS points collected with more accurate static GPS methods. Standard error for individual points can be inserted into the raw data file. The following is the menu option used to insert standard errors into the raw file. Notice in the above raw data file that points TR1 and TR100 are the control points for this project. Also, notice there is a standard error record, CSE, preceding the control points.



The CSE record has the character '!' in the N,E,& Z field. The character '!' designates that all following control points will be fixed. Points that are fixed will not be adjusted during the adjustment. Placing a very small standard error on a control point is almost equivalent to fixing the point. Points can also be designated to be floating points by using the '#' character. The only practical use of creating a floating point is if SurvNET cannot compute preliminary coordinates because no control point is occupied. The surveyor can compute a preliminary value for one of the occupied points, and insert that point as a floating point. The floating point will be adjusted, and no weight will be given to the floating coordinate values.

Standard error records effect all the records that follow the standard error record. To revert the standard errors back to the default values, a CSE record can be inserted containing the

'∗' character. In the following example, point TR1 has been designated as a fixed point. TR100 has a north standard error of .02 and and east standard error of .01. Following the TR100 point record there is a CSE record containing the '∗' character. So, if there were any control points further down in the raw data file they would use the default standard errors as set in the project settings dialog box.

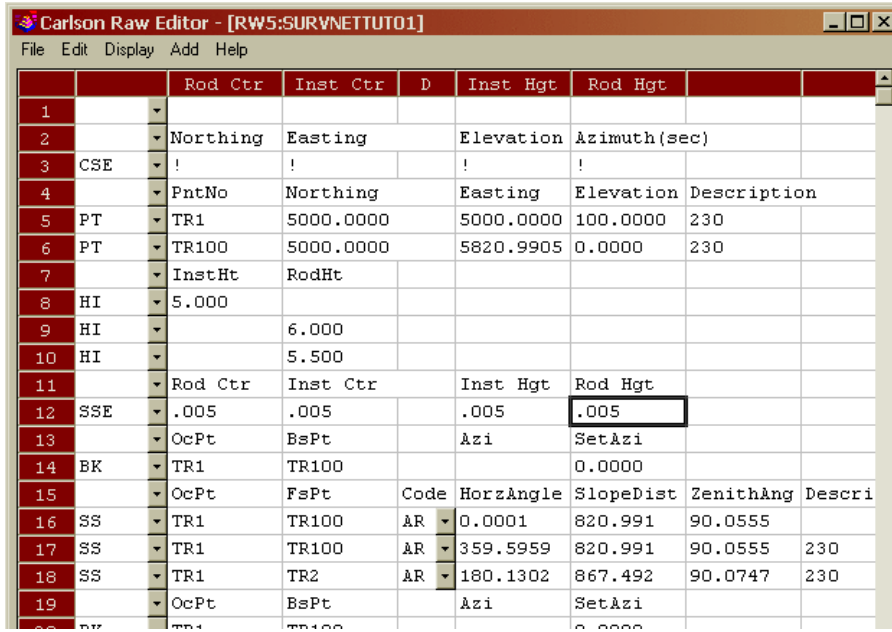


1								
2		Northing	Easting		Elevation	Azimuth(sec)		
3	CSE	!	!		!	!		
4		PntNo	Northing		Easting	Elevation	Description	
5	PT	TR1	5000.0000		5000.0000	100.0000	230	
6		Northing	Easting		Elevation	Azimuth(sec)		
7	CSE	.02	.01		!	*		
8		PntNo	Northing		Easting	Elevation	Desc	
9	PT	TR100	5000.0000		5820.9905	0.0000	230	
10		Northing	Easting		Elevation	Azimuth(sec)		
11	CSE	*	*		*	*		
12		InstHt	RodHt					
13	HI	5.000						
14	HI		6.000					
15	HI		5.500					
16		OcPt	BsPt		Azi	SetAzi		
17	BK	TR1	TR100			0.0000		
18		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Descri

There may be times when non-control standard errors need to be overridden for certain measurements. For example, if fixed tripods were used for backsights and foresights for part of the traverse, and hand-held rods were used for another portion of the traverse, it would be appropriate to have differing 'Rod Ctr' standard errors for the different sections of the raw data.

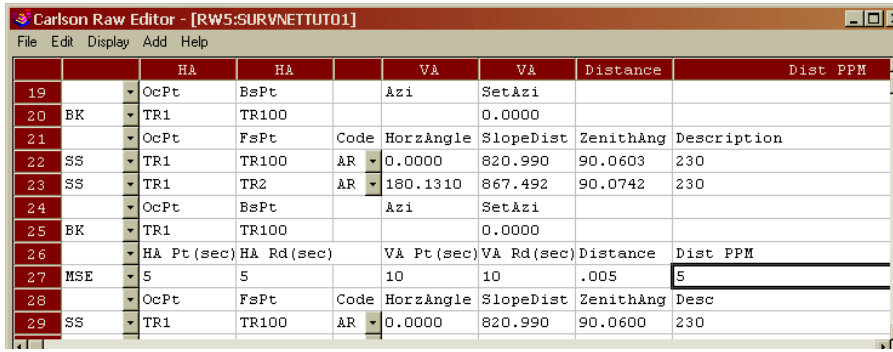
Standard errors for angles and distances can also be inserted into the raw data file using the Add menu options *Setup Standard Error* and *Measurement Standard Error*. The standard errors set by these inserted records override the default standard errors. In the following example, a setup standard record, SSE record, has been inserted in record 12. The SSE record effects all setup data that follow until another SSE record is inserted. In the following example, the foresight rod centering error is set to .005, the total station centering error is set to .005, the total

station meaure-up error is set to .005 and the foresight measure-up error is set to .005.



		Rod Ctr	Inst Ctr	D	Inst Hgt	Rod Hgt		
1								
2		Northing	Easting		Elevation	Azimuth(sec)		
3	CSE	!	!		!	!		
4		PntNo	Northing		Easting	Elevation	Description	
5	PT	TR1	5000.0000		5000.0000	100.0000	230	
6	PT	TR100	5000.0000		5820.9905	0.0000	230	
7		InstHt	RodHt					
8	HI	5.000						
9	HI		6.000					
10	HI		5.500					
11		Rod Ctr	Inst Ctr		Inst Hgt	Rod Hgt		
12	SSE	.005	.005		.005	.005		
13		OcPt	BsPt		Azi	SetAzi		
14	BK	TR1	TR100			0.0000		
15		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Descri
16	SS	TR1	TR100	AR	0.0001	820.991	90.0555	
17	SS	TR1	TR100	AR	359.5959	820.991	90.0555	230
18	SS	TR1	TR2	AR	180.1302	867.492	90.0747	230
19		OcPt	BsPt		Azi	SetAzi		

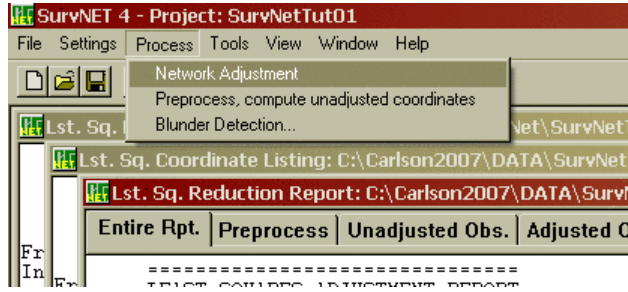
The following is another example where it would be appropriate to insert a measurement standard error record, MSE, into the raw data. If two different total stations with different accuracy specifications were used to collect the data, it would be approriate to have different standard errors for the different sections of the raw file, depending on which total station was used to collect the data. In the following example, a MSE record has been inserted for record 27. The horizontal pointing and reading error has been changed to 5 seconds, and the vertical pointing and reading error has been changed to 10 seconds. The inserted MSE record will effect all following raw data until another MSE is inserted.



		HA	HA		VA	VA	Distance	Dist PPM
19		OcPt	BsPt		Azi	SetAzi		
20	BK	TR1	TR100			0.0000		
21		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Description
22	SS	TR1	TR100	AR	0.0000	820.990	90.0603	230
23	SS	TR1	TR2	AR	180.1310	867.492	90.0742	230
24		OcPt	BsPt		Azi	SetAzi		
25	BK	TR1	TR100			0.0000		
26		HA Pt(sec)	HA Rd(sec)		VA Pt(sec)	VA Rd(sec)	Distance	Dist PPM
27	MSE	5	5		10	10	.005	5
28		OcPt	FsPt	Code	HorzAngle	SlopeDist	ZenithAng	Desc
29	SS	TR1	TR100	AR	0.0000	820.990	90.0600	230

Least Squares Processing

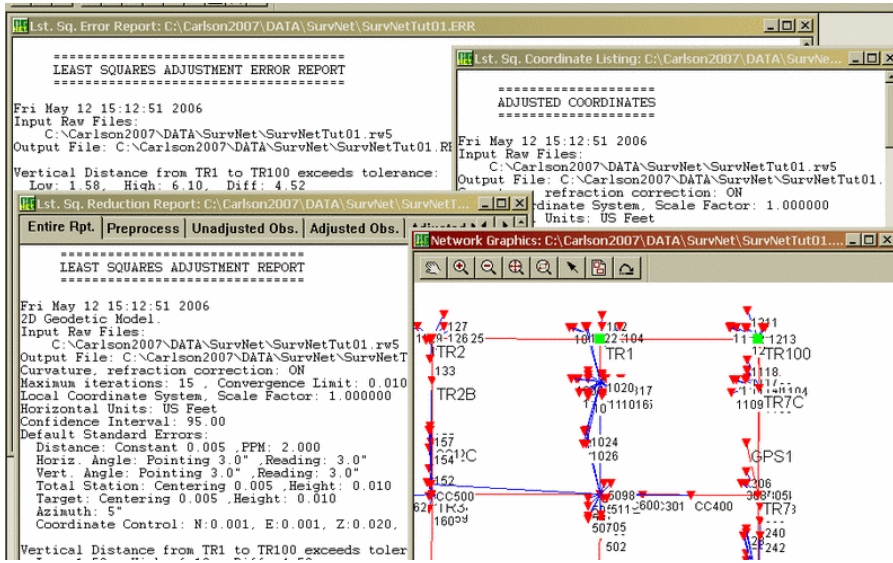
12 After exiting the raw data editor, we are ready to perform the least squares adjustment. From the Process menu, choose the *Network Adjustment* option.



The least squares adjustment is performed, and the results from the adjustment are displayed. If the solution converged correctly, the report should look similar to the following window. If there were errors or the solution did not converge, an error message dialog will be generated.

If there are errors, you will need to return to the raw data editor to review and edit the raw data. Since the tutorial example should have converged, we will next review the reports generated by the least squares adjustment. There are four windows created by the least squares program during processing. These files include the .err file, which contains any errors or warnings that were generated during processing. The .rpt file is the primary least squares report file summarizing

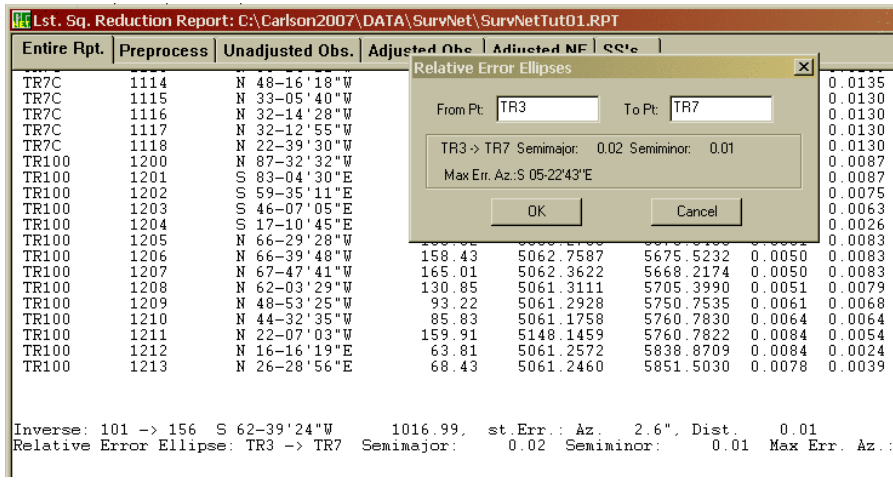
the data and the results from the adjustment. An .out file is created containing a listing of the final coordinates. There is also a Graphics window that is displayed. The graphic window is temporary and useful only for seeing the results of the survey. To bring up the Graphics window, choose under the Window menu the *Graphics* command, or click the View Graphics icon on the toolbar.



Relative Error Ellipses

Relative error ellipses are a statistical measure of the expected error between two points. Regular error ellipses are a measure of the absolute error of a single point. Some survey accuracy standards such as the ALTA standards state the maximum allowable error between any two points in a survey. Relative error ellipses can give you this information. There is a more detailed ALTA reporting feature in SurvNET. See the manual for additional information on creating an ALTA report.

13 Press the Relative Error Ellipse toolbar icon button, or choose, off of the Tools menu, *Relative Error Ellipse*. Enter TR3 and TR7 in the From Pt. and To Pt. fields. Press OK to calculate. The dialog box should look as follows.



At the 95% confidence level there should only be around .02 feet of error between points TR3 and TR7. If you need to compute relative error ellipses for sideshots make sure the "Enable sideshots for error ellipse" toggle is set in the Adjustment tab of the Settings/Project dialog box.

Review of the Least Squares Report

14 In this section, the different sections of the least squares report are explained. If the Least Squares Report is not already showing, choose the Window menu and select the *Least Square Report* item. The report viewer has tabs to quickly access different sections of the report.

Preprocessing and Header Information

The following excerpt from the report shows the header information and the preprocessing results. The header information consists of the date and time, the input and output file names, the coordinate system, the curvature/refraction setting, maximum iterations, and distance units.

During the preprocessing process, multiple angles are reduced to a single angle and multiple slope distances, vertical angles, HI's, and rod heights are reduced to a single horizontal distance and vertical difference. During this process the horizontal angle, horizontal distance, and vertical difference spreads are computed. If the spreads exceed the tolerance settings from the Settings dialog box, then a warning message is displayed showing the high and low measurement and the difference between the high and low measurement.

```
     ================================
     LEAST SQUARES ADJUSTMENT REPORT
     ================================

Wed May 17 11:40:37 2006
2D Geodetic Model.
Input Raw Files:
    C:\Carlson2007\DATA\SurvNet\SurvNetTut01.rw5
Output File: C:\Carlson2007\DATA\SurvNet\SurvNetTut01.RPT
Curvature, refraction correction: ON
Maximum iterations: 15 , Convergence Limit: 0.010000
Local Coordinate System, Scale Factor: 1.000000
Horizontal Units: US Feet
Confidence Interval: 95.00
Default Standard Errors:
  Distance: Constant 0.005 ,PPM: 2.000
  Horiz. Angle: Pointing 3.0" ,Reading: 3.0"
  Vert. Angle: Pointing 3.0" ,Reading: 3.0"
  Total Station: Centering 0.005 ,Height: 0.010
  Target: Centering 0.005 ,Height: 0.010
  Azimuth: 5"
  Coordinate Control: N:0.001, E:0.001, Z:0.020,

Horizontal Distance from TR1 to TR100 exceeds tolerance:
  Low: 820.99,  High: 820.99,  Diff: 0.01

Vertical Distance from TR1 to TR100 exceeds tolerance:
  Low: 1.58,  High: 6.10,  Diff: 4.52

Horizontal Distance from TR1 to TR2 exceeds tolerance:
  Low: 867.48,  High: 867.49,  Diff: 0.01

Vertical Distance from TR1 to TR2 exceeds tolerance:
```

Unadjusted Measurements

The following excerpt from the report shows the unadjusted measurements. Measurements consist of some combination of control X, and Y, horizontal distances, horizontal angles, and azimuth measurements. These measurements consist of a single averaged measurement. For example, if multiple distances were collected between two points during data collection, only the single averaged measurement is used in the least squares adjustment.

Also, standard errors for the measurements are displayed in this section of the report. The standard errors are computed from the standard error setting in the Settings dialog box using error propagation formulas. The standard error of an angle that was measured several times would typically be lower than an angle that was measured only once.

If the data had been adjusted into NAD 83 coordinates both the ground distances and the grid distances would be displayed. The grid, elevation, and combined factor would also be displayed in this section of the report.

```
Unadjusted Observations
=======================

Control Coordinates:     0 Observed Points,    2 Fixed Points,    0 Approx. Points
 Sta.            N:            E:           StErr N:   StErr E:
 TR1          5000.0000     5000.0000       FIXED      FIXED
 TR100        5000.0000     5820.9905       FIXED      FIXED

Distances:  164 Observations
 From Sta.   To Sta.            Dist.        StErr
 TR1           TR100             820.99        0.01
 TR1           TR2               867.49        0.01
                      .
                      .
                      .

Angles:  236 Observations
 BS Sta.   Occ. Sta.   FS Sta.          Angle          StErr (Sec.)
 TR100        TR1         TR2         180-13'02"             6
 TR100        TR1         TR2         180-13'10"             6
                      .
                      .
                      .|
```

Adjusted Coordinates

The next section of the report shows the final adjusted coordinates. Additionally, the computed standard errors of the coordinates are displayed. If this project was reduced to NAD 83, the final latitude and longitudes are also displayed. Error ellipses computed to the 95 percent confidence interval are also displayed.

```
Adjusted Coordinates
====================

Adjusted Local Coordinates
 Sta.            N:            E:           StErr N:   StErr E:
 TR2          5003.3244     4132.5148       0.0062     0.0052
 TR1B         4781.5725     4998.9887       0.0059     0.0041
 TR3          4198.7621     4130.5829       0.0078     0.0064
                                  .
                                  .
                                  .


Adjusted Coordinates Error Ellipses, 95% CI
 Sta.              Semi Major      Semi Minor      Max. Error Az.
                      Axis            Axis
 TR2                 0.0160          0.0122          N 23-48'37"E
 TR1B                0.0147          0.0102          N 00-15'55"E
 TR3                 0.0211          0.0136          S 31-13'06"E
 TR2C                0.0286          0.0216          S 70-53'51"E
 TR2B                0.0222          0.0178          S 06-45'02"E
                                  .
                                  .
                                  .|
```

Adjusted Measurements

The following section from the report shows the final adjusted measurements. This section is one of the most important sections to review when analyzing the results of the adjustment. In addition to the adjusted measurement, the residual is displayed. The residual is the amount of adjustment applied to the measurement. The residual is computed by subtracting the unadjusted measurement from the adjusted measurement.

The standard deviation of the measurement is also displayed. Ideally, the computed standard deviation and residual and the standard error displayed in the unadjusted measurement would all be of similar magnitude. The standard residual is a measure of the similarity of the residual to the a-priori standard error. The standard residual is the measurements residual divided by the standard error displayed in the unadjusted measurement section. A standard residual greater than 2 is marked with an "*". A high standard residual may be an indication of a blunder. If there are consistently a lot of high standard residuals it may indicate that the original standard errors set in the Settings dialog box were not realistic.

```
Adjusted Observations
=====================

Adjusted Distances
 From Sta.   To Sta.        Distance      Residual      StdRes.    StdDev
 TR1           TR100          820.99     -0.00           0.06      0.00
 TR1           TR2            867.49      0.01           0.71      0.01
 TR1           TR1B           218.43      0.00           0.00      0.01
 TR2           TR3            804.56     -0.00           0.63      0.01
 TR2           TR2C           535.71      0.00           0.00      0.01
 TR2           TR2B           220.29      0.00           0.00      0.01
 TR3           TR4            491.92     -0.01           0.92      0.01
 TR4           TR5            871.24     -0.00           0.57      0.01
 TR5           TR6            823.00     -0.00           0.51      0.01
 TR6           TR7            485.83      0.02       *   2.33      0.01
                                                .
                                                .
                                                .
            Root Mean Square (RMS)              0.01

Adjusted Angles
 BS Sta.   Occ. Sta.   FS Sta.                Angle          Residual      StdRes    StdDev(Sec.)
 TR100       TR1           TR2            180-13'10"            8             1          1
 TR100       TR1           TR2            180-13'10"            0             0          1
                                                .
                                                .
                                                .
 TR5         TR6           TR7             090-17'58"           15       *    2          1
                                                .
                                                .
                                                .|
 TR7         TR7B          TR1             269-47'45"           -2             0          1
 TR7         TR7B          TR1             269-47'45"            2             0          1
 TR7         TR7B          TR1             269-47'45"            1             0          1
 TR7         TR7B          TR3             179-50'03"            7             1          2
 TR7         TR7B          TR5             089-59'55"           -1             0          3
                              Root Mean Square (RMS)             4
```

Statistics

The next section displays some statistical measures of the adjustment including the number of iterations needed for the solution to converge, the degrees of freedom of the network, the reference variance, the standard error of unit weight, and the results of a Chi-square test.

The degree of freedom is an indication of how many redundant measurements are in the sur-

vey. Degree of freedom is defined as the number of measurements in excess of the number of measurements necessary to solve the network.

The standard error of unit weight relates to the overall adjustment and not to an individual measurement. A value of one indicates that the results of the adjustment are consistent with the a priori standard errors. The reference variance is the standard error of unit weight squared.

The chi-square test is a test of the "goodness" of fit of the adjustment. It is not an absolute test of the accuracy of the survey. The a-priori standard errors which are defined in the project settings dialog box or with the SE record in the raw data file are used to determine the weights of the measurements. These standard errors can also be looked at as an estimate of how accurately the measurements were made. The chi-square test merely tests whether the results of the adjusted measurements are consistent with the a priori standard errors. Notice that if you change the project standard errors and then reprocess the survey the results of the chi-square test change, even though the measurements themselves did not change.

In our example the chi-square test failed at the 95% significant level. Our example failed the chi-square test on the low end, 52.6 is less than 60.5. Failing on the low end indicates that our data is actually better than expected compared to our a-priori standard errors. If we were to decrease the pointing and reading standard error in the Settings screen by 5-10 seconds we would probably pass the chi-square. Also notice that if you change the standard errors by only 5-10 seconds and reprocess the data the final coordinates will not change significantly.

```
Statistics
==========

 Solution converged in 2 iterations
 Degrees of freedom:84
 Reference variance:0.63
 Standard error unit weight: +/-0.79
 Failed the Chi-Square test at the 95.00 significance level
 60.540 <= 52.627 <= 111.242
```

Sideshots

If the "Enable sideshots for relative error ellipses" is not set in in the Adjustment screen of the project settings screen, sideshots are computed separately after the adjustment is completed.

Sideshots
=========

From	To	Bearing	Dist.	N	E	StDev. N	StDev. E
TR1	100	S 72-22'23"E	20.66	4993.7449	5019.6865	0.0026	0.0083
TR1	101	S 74-30'42"E	23.26	4993.7893	5022.4128	0.0023	0.0084
TR1	102	N 04-55'59"E	124.11	5123.6541	5010.6728	0.0088	0.0008
TR1	103	N 09-19'36"E	64.60	5063.7459	5010.4693	0.0086	0.0014
TR1	104	N 57-42'41"E	118.78	5063.4480	5100.4090	0.0047	0.0074
TR1	105	N 65-59'21"W	152.17	5061.9176	4861.0016	0.0050	0.0082
TR1	106	N 68-32'48"W	169.16	5061.8696	4842.5590	0.0051	0.0084
			.				
			.				
			.				

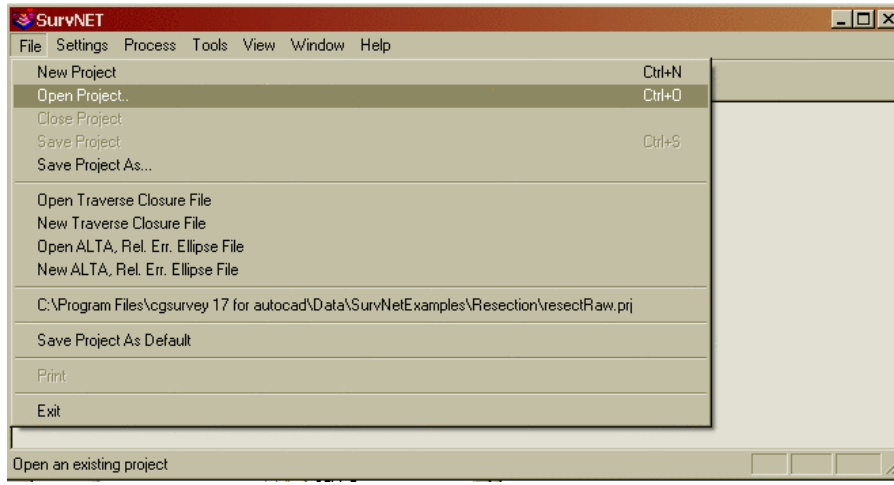
If the project had valid elevation benchmarks and measured HI's and rod heights the project could have been defined to adjust elevations. When using the 2D/1D least squares model the horizontal and the vertical adjustments are separate least squares adjustment processes. As long as there are redundant vertical measurements the vertical component of the network can also be reduced and adjusted using least squares. In the vertical adjustment, benchmarks are held fixed.

This is the final step in the adjustment. The final adjusted coordinates are now stored in the current project point database and can now be used for mapping and design.

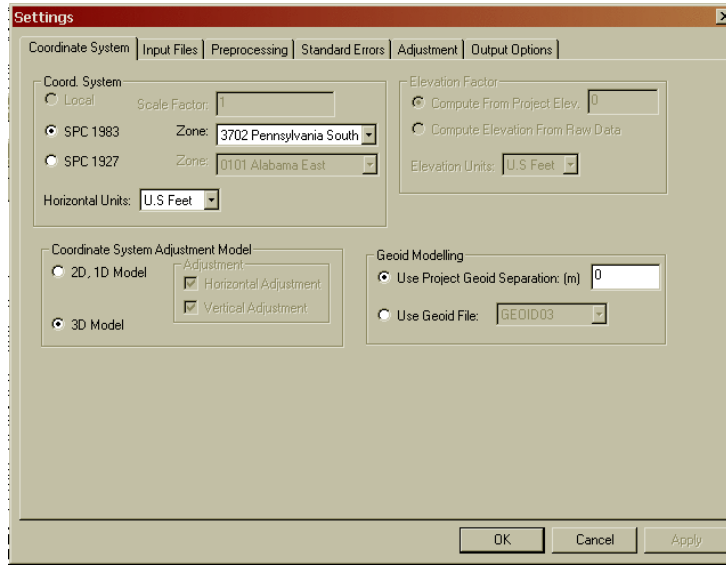
Lesson Two - Processing a 3D Network With Both Total Station Data and GPS Vectors

In this lesson we will process a project that contains both GPS vectors and total station measurements.

1 Following is the opening SurvNET window. The first step is to open the project for lesson two. Choose the File/Open Project.. option. Navigate to the \Carlson2007\Data\ subdirectory and open the SurvNetTut02 project.

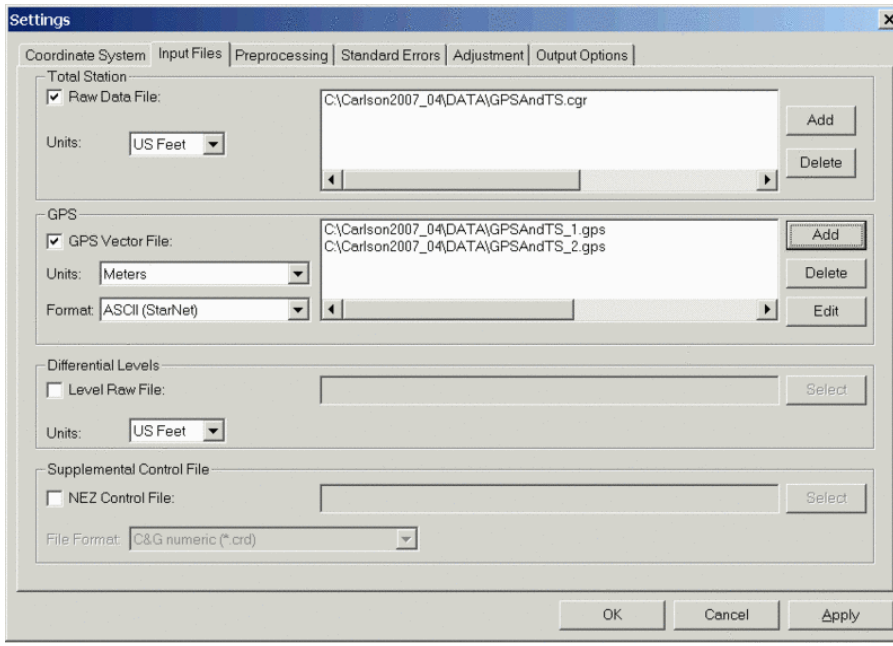


2 Let's review the project settings. Go to Settings/Project.



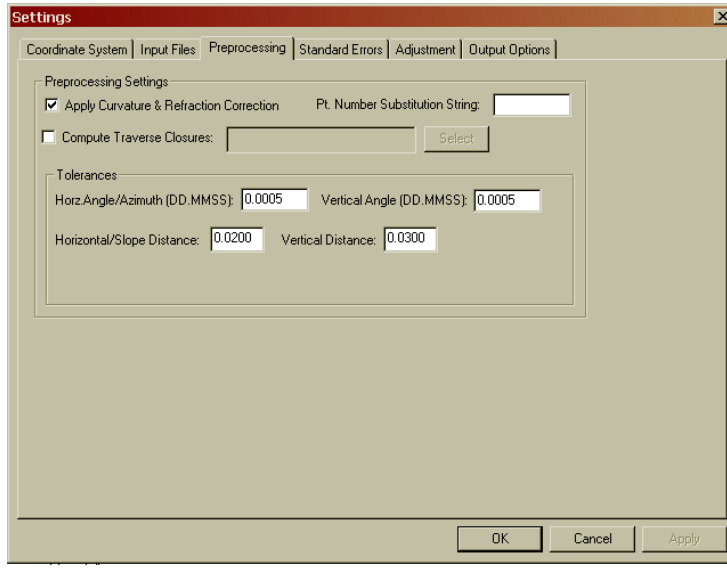
In order process GPS vectors, the coordinate system must be set to 'SPC 1983' with the appropriate state plane zone. The 'Coordinate System Adjustment Model' must be set to the 3D Model.

With the 3D model, horizontal units and vertical units must be the same in regards to output and total station raw data. Geoid modeling may or may not be important depending on the extent of the project and the accuracies required. The most accurate results are typically obtained by using a 'Geoid File' set to GEOID03.

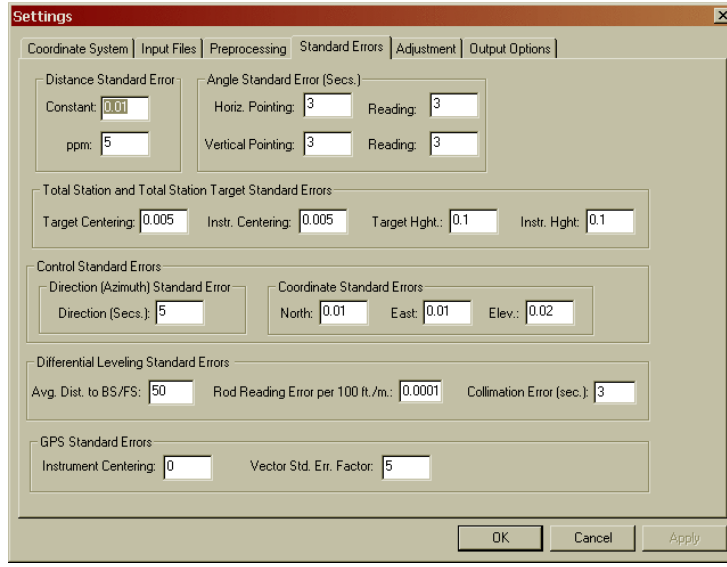


The project raw data is defined from the 'Input Files' settings screen. Notice that the units need to be specified for both the GPS vector data and the total station raw data. Typically, but not always, GPS vectors are in meters while the total station and the final output may need to be in feet. Also make sure that the correct GPS vector format is correct. Some GPS formats are binary and cannot be edited easily. Sometimes it is needed to edit the GPS vectors usually in terms of point numbers.

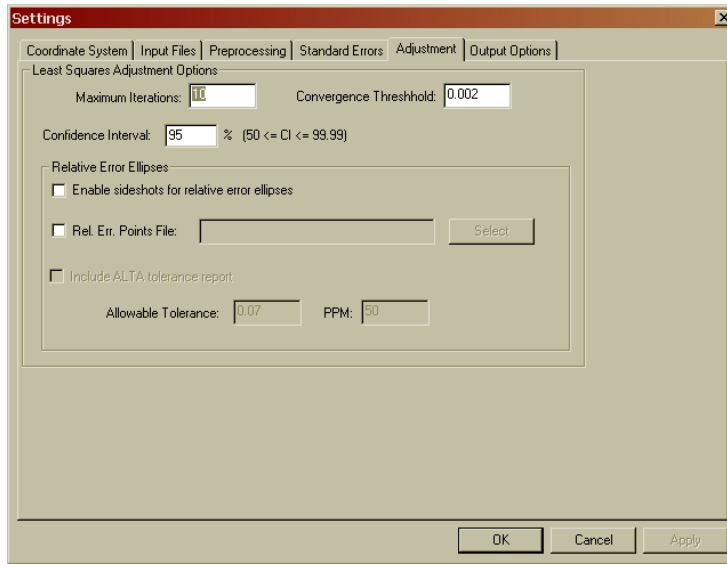
Note: The sample tutorial project has the input raw file in the default data folder of C:\Carlson2007\Data. If you have a different data directory, then set the correct data file by highlighting the default file, pick Delete and then pick Add and select GPSAndTS.cgr (C&G format raw file) from your data folder. Do the same for the GPS Vector files of GPSAndTS1.gps and GPSAndTS2.gps.



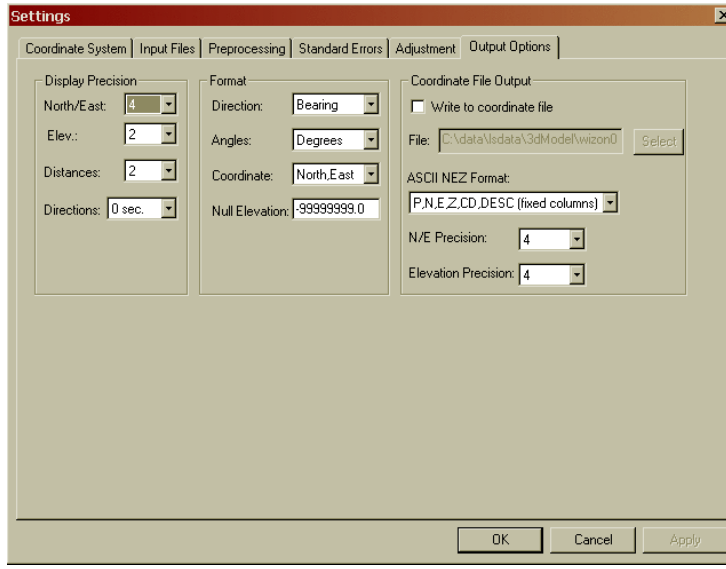
Though this tutorial does not cover the topic, it is from this screen that you would define the traverse file needed to compute either GPS loop closures or totals station traverse closure. See the manual for further details.



Notice the standard error settings related to GPS. The GPS instrument centering error can be defined. The vector standard error is a factor that can be used to increase the standard errors as defined in the GPS vector files.

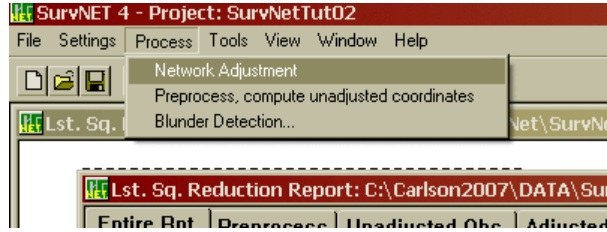


None of the settings in this screen are specific to processing GPS vectors. See the manual for details on the settings in the 'Adjustment' dialog box.

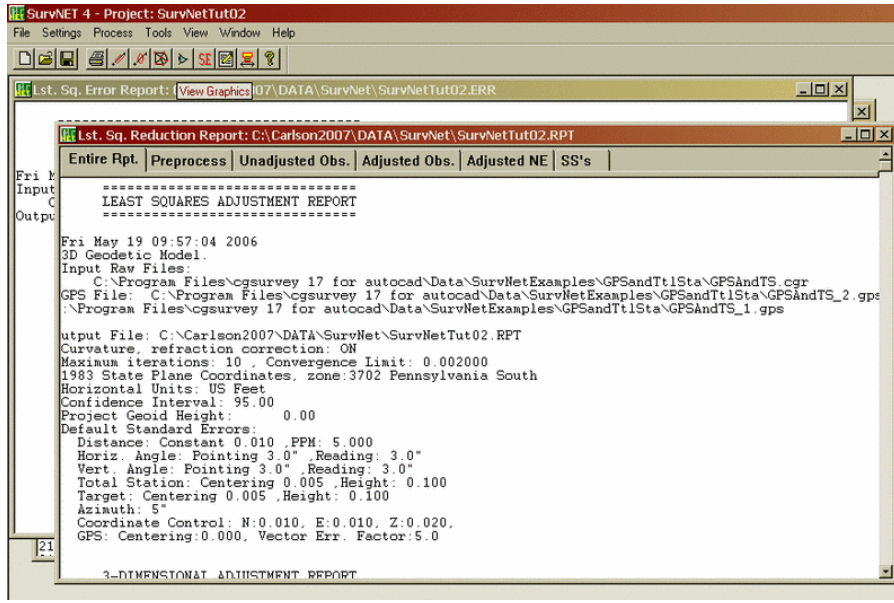


None of the settings in this screen are specific to processing GPS vectors. See the manual for details on the settings in the 'Output' dialog box. Press the OK to return to the main SurvNET dialog box.

3 Following is the main SurvNET window. To process the data chose the Process/Network Adjustment option.



The project should process and converge and the following windows should be displayed.


SurvNET 4 - Project: SurvNetTut02
File Settings Process Tools View Window Help
Lst. Sq. Error Report: View Graphics 07\DATA\SurvNet\SurvNetTut02.ERR
Lst. Sq. Reduction Report: C:\Carlson2007\DATA\SurvNet\SurvNetTut02.RPT
Entire Rpt. Preprocess Unadjusted Obs. Adjusted Obs. Adjusted NE SS's
LEAST SQUARES ADJUSTMENT REPORT
Fri May 19 09:57:04 2006
3D Geodetic Model.
Input Raw Files:
C:\Program Files\cgsurvey 17 for autocad\Data\SurvNetExamples\GPSandTtlSta\GPSAndTS.cgr
GPS File: C:\Program Files\cgsurvey 17 for autocad\Data\SurvNetExamples\GPSandTtlSta\GPSAndTS_2.gps
:\Program Files\cgsurvey 17 for autocad\Data\SurvNetExamples\GPSandTtlSta\GPSAndTS_1.gps
utput File: C:\Carlson2007\DATA\SurvNet\SurvNetTut02.RPT
Curvature, refraction correction: ON
Maximum iterations: 10 , Convergence Limit: 0.002000
1983 State Plane Coordinates, zone:3702 Pennsylvania South
Horizontal Units: US Feet
Confidence Interval: 95.00
Project Geoid Height: 0.00
Default Standard Errors:
Distance: Constant 0.010 ,PPM: 5.000
Horiz. Angle: Pointing 3.0" ,Reading: 3.0"
Vert. Angle: Pointing 3.0" ,Reading: 3.0"
Total Station: Centering 0.005 ,Height: 0.100
Target: Centering 0.005 ,Height: 0.100
Azimuth: 5"
Coordinate Control: N:0.010, E:0.010, Z:0.020,
GPS: Centering:0.000, Vector Err. Factor:5.0
3-DIMENSIONAL ADJUSTMENT REPORT

Let's review sections of the report that are unique to the processing of GPS vectors and the 3D model.

```
Unadjusted Observations
=======================

Control Coordinates:     1 Observed Points,     0 Fixed Points,     0 Approx. Points
 Sta.          Latitude          Longitude          Z (Ellip.)   StErr N:   StErr E:   StErr Z:
 200        40-18'38.59054"N  76-12'53.63661"W       858.21   0.0030     0.0030     0.0043

Grid XYZ
 Sta.            N:            E:           Z (Geoid):   StErr N:    StErr E:  StErr Z:
 200         359769.1900  2396585.1700        858.21      0.0030      0.0030    0.0043

Geocentric XYZ
 Sta.            X:            Y:            Z:         StErr X:    StErr Y:  StErr Z:
 200        1160584.9395  -4730365.2299  4104524.27      0.0009      0.0009    0.0013
```

Notice that now that we are working with a specific datum instead of an assumed coordinate system that latitude/longitude, state plane coordinates and geocentric coordinates are all displayed.

```
Mark to Mark Slope Distances:  192 Observations
 From Sta.   To Sta.            Dist.        StErr
 200           201               352.78        0.03
 200           202               344.09        0.03
 200           203               170.89        0.03
 200           204               149.60        0.03
                                   .
                                   .
                                   .

Mark to Mark Vertical Angles:  192 Observations
 From Sta.   To Sta.         Vertical Ang.              StErr (Sec.)
 200           201             097-58'35"                4
 200           202             077-56'37"                4
 200           203             066-54'34"                4
 200           204             079-12'50"                4
                                   .
                                   .
                                   .

Horizontal Angles:  191 Observations
 BS Sta.   Occ. Sta.   FS Sta.          Angle          StErr (Sec.)
 201           200         202         131-40'05"            8
 201           200         203         243-43'37"           11
 201           200         204         176-40'38"           12
 201           200         205         168-43'47"           14
                                   .
                                   .
                                   .

GPS Vectors:   17 Observations
 From Sta.        Delta X   Variance Delta X   Covariance XY
 To   Sta.        Delta Y   Variance Delta Y   Covariance XZ
                  Delta Z   Variance Delta Z   Covariance YZ

 200              -644.939      0.0002619       -0.0001134
 362               262.430      0.0003951        9.885E-005
                   366.966       0.001285       -6.889E-005

 200              -599.575         0.0003        2.555E-005
 335               245.495      0.0007998       -5.851E-005
                   340.435        0.00124        -0.0004986
```

In the above unadjusted observations section of the report, notice that distances have been converted to mark to mark distances. Note that vertical angles are now treated as measurements in the 3D model. And lastly, notice that the GPS vectors are also displayed. The GPS vectors are displayed as delta X,Y,&Z in the geocentric coordinate system.

```
Adjusted Geographic Coordinates
 Sta.        Latitude          Longitude          Z (Ellip.)   Conv. Ang.     Grid Factor   Z Factor   Combined Factor
 200      40-18'38.59054"N  76-12'53.63661"W       858.21   000-59'45"     0.99996247   0.99995895   0.99992142
 201      40-18'39.12410"N  76-12'58.09197"W       809.26   000-59'43"     0.99996246   0.99996129   0.99992376
                                                    .
                                                    .
                                                    .

Adjusted Grid Coordinates, (US Feet)
 Sta.          N:           E:          Z (Geoid):   StErr N:    StErr E:   StErr Z:
 200       359769.1889  2396585.1702       858.21   0.0029      0.0029    0.0041
 201       359817.1761  2396239.1441       809.26   0.0256      0.0213    0.0087
 202       359987.4151  2396841.2660       930.08   0.0244      0.0214    0.0091
                                                    .
                                                    .
                                                    .
```

In the above adjusted coordinate section of the report, notice that the grid, elevation, and combined factor are displayed with the adjusted geographic coordinates.

```
Adjusted Mark to Mark Distances
 From Sta.  To Sta.        Distance      Residual     StdRes.   StdDev
 200           201           352.78     -0.00          0.11     0.03
 200           202           344.09     -0.01          0.32     0.02
                                        .
                                        .
                                        ,
            Root Mean Square (RMS)       0.00

Adjusted Angles
 BS Sta.  Occ. Sta.   FS Sta.              Angle          Residual      StdRes    StdDev(Sec.)
 201          200          202          131-40'08"           3             0          8
 201          200          203          243-43'37"           -0            0          10
                                        .
                                        .
                                        ,
                                Root Mean Square (RMS)          2

Adjusted vertical angles
 From Sta.   To Sta.    Vertical Ang.          Residual    StdRes   StdDev(Sec.)
 200           201         097-58'33"           2             0          10
 200           202         077-56'36"           1             0          10
                                        .
                                        .
                                        ,
|               Root Mean Square (RMS)          1

GPS Vectors:   17 Observations
 From Sta.          Delta X    Residual    StdRes    StdDev
 To   Sta.          Delta Y    Residual    StdRes    StdDev
                    Delta Z    Residual    StdRes    StdDev

 200                -644.9393     0.0000        0.00      0.0009
 362                 262.4304    -0.0000        0.00      0.0009
                     366.9660    -0.0001        0.00      0.0012

 200                -599.5761    -0.0015        0.08      0.0113
 335                 245.4919    -0.0032        0.11      0.0139
                     340.4524     0.0175        0.49      0.0126

 202                -117.4878     0.0026        0.23      0.0111
 BAS1               -106.6137     0.0289        1.37      0.0129
                    -160.2539    -0.0278        0.88      0.0124
```

In the above adjusted measurements section the adjusted measurements are shown along with their residuals, standard residuals and standard deviation.

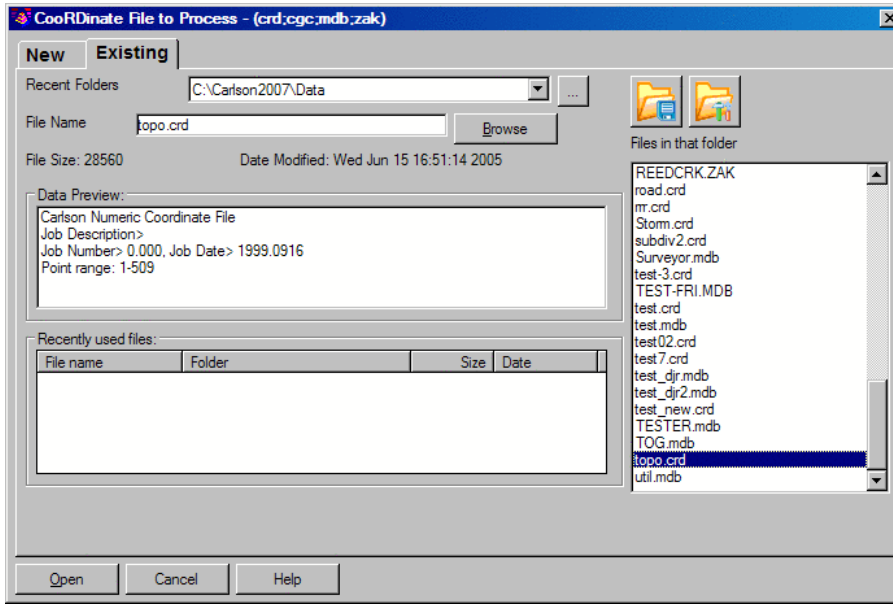
This completes the Lesson 5 tutorial title SurvNET.

Lesson 6: Contouring, DTM and Design

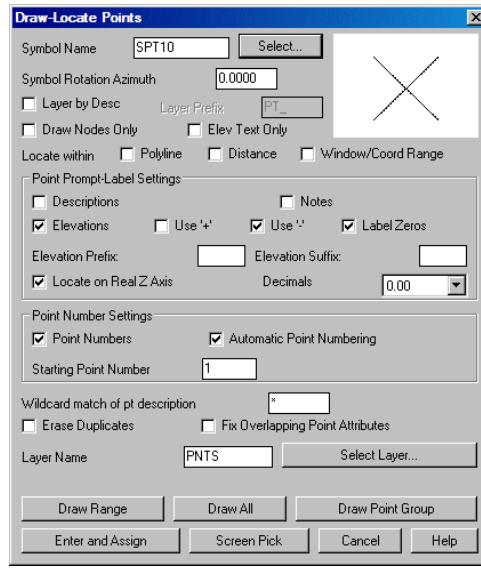
This is the easiest of the tutorials, and could be completed in as little as three minutes. If that's all the time you have, and you have purchased the Civil Design program, do this one first!

1 Click the icon for Carlson and start-up Carlson/AutoCAD from Windows.

2 Once in Carlson, start a new drawing, exit out of the Start Wizard (if it appears) and go straight to the Points pulldown menu. Choose *Set Coordinate File*. You will then be asked to choose the coordinate file that you want to use. Select Topo.crd as shown here, and click Open.

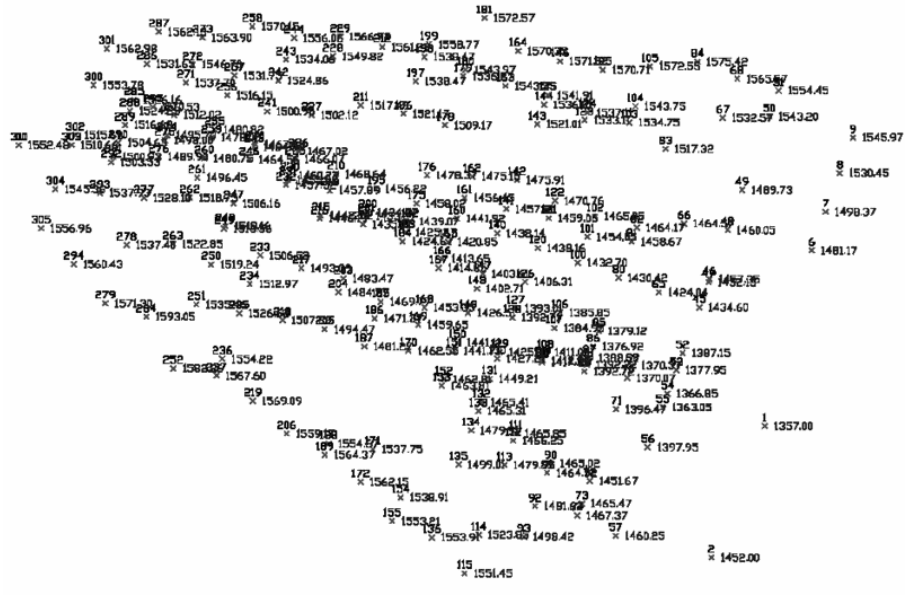


Now go to *Draw-Locate Points*, under the Points pulldown menu. You obtain this dialog:

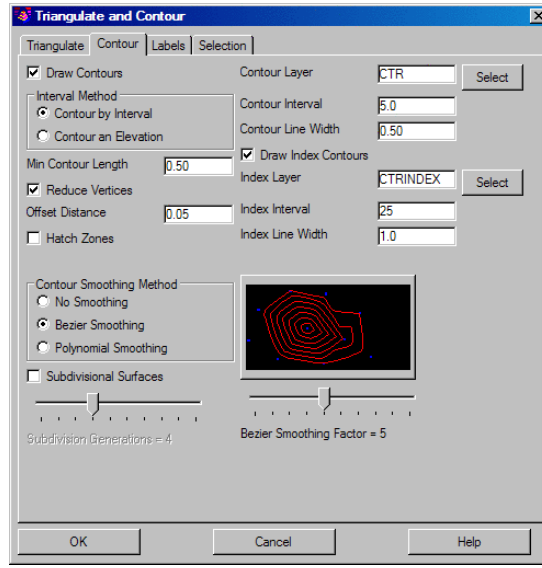


Choose Symbol 10 by clicking Select at the top of the dialog, then picking Symbol SPT10 from the options that appear. All other settings are default. Verify that you match what appears here. Then click the option Draw All.

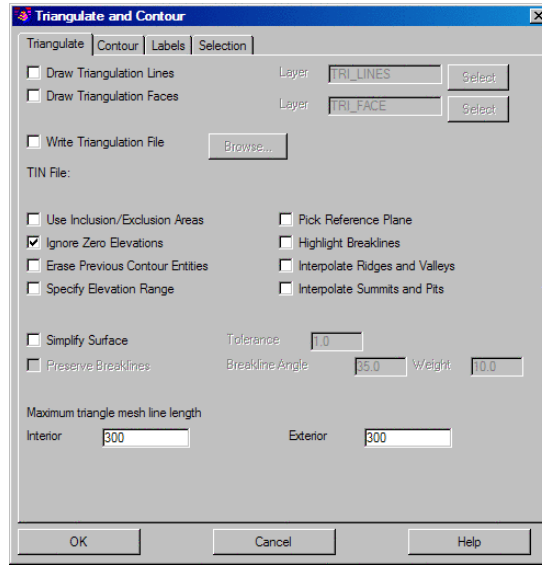
The points immediately plot on the screen, and the program zooms to the extents of the points. If you don't see the points, select *Extents* under View. The point plot is shown below:



3 Triangulate & Contour. Be sure you are in the Civil Design program. Under the Surface pulldown menu, pick *Triangulate & Contour*. The following dialog boxes will appear which you should fill out as shown. We'll start with the Contour tab.



In the Contour tab, as shown above, set the contour interval to 5.0, turn on Draw Index Contours and set its interval to 25.0 (index intervals are most often 5 times the standard contour interval).



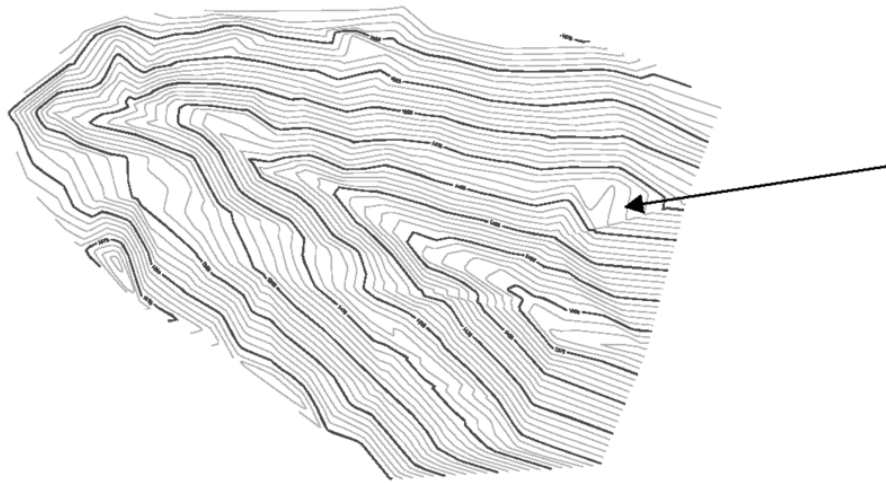
In the Triangulate tab, as shown above, set the maximum Tmesh line lengths to 300 in all cases. If the goal of the field crew was never to shoot points further apart then 100 feet, then certainly triangulation over 300 feet can be ignored.

In the Labels tab, we want to label index contours only (so its not too busy) and do 2 internal labels per contour. This works very well for a valley. It puts a contour label on each side of the valley. Sometimes you may prefer to label a specific length of contour.

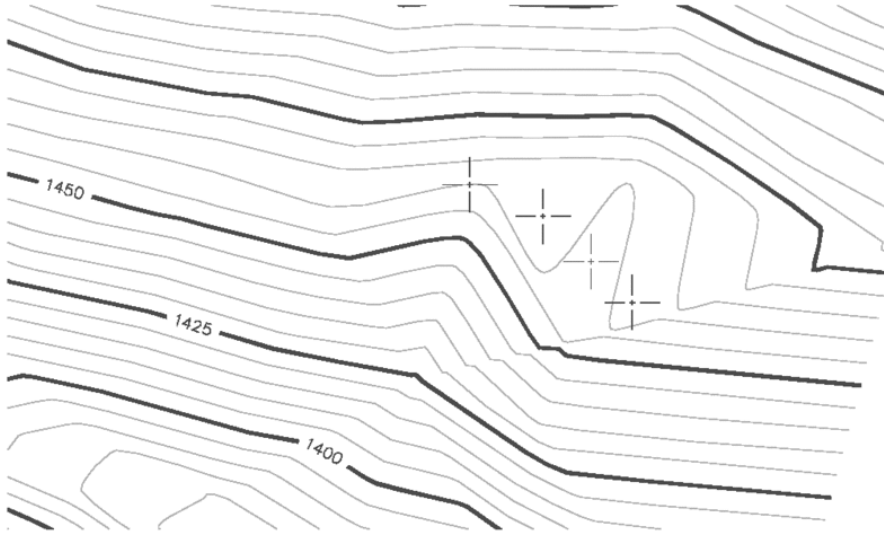
Fill the dialogs in as shown, and press OK.

Select the points and breaklines to Triangulate.
Select objects: ALL (All means select everything visible on the screen) **615 found**
Select objects: *press ENTER* (for no more)
Range of Point Numbers to use [<All>/Group]: *press ENTER*

The contours are drawn. Now, choose the command *Freeze Layer* and pick on one of the points (its number or its elevation), and press Enter. The points freeze. Here is the plot so far:



4 Edit Contours. The arrow above points to an area that needs editing. This area is enlarged below. You may want to zoom into this area for the next edit operation, and zoom back out when you are finished.



Choose the command *Edit Contours*. This is found by going to the Surface pulldown menu and choosing *Modify Contours*.

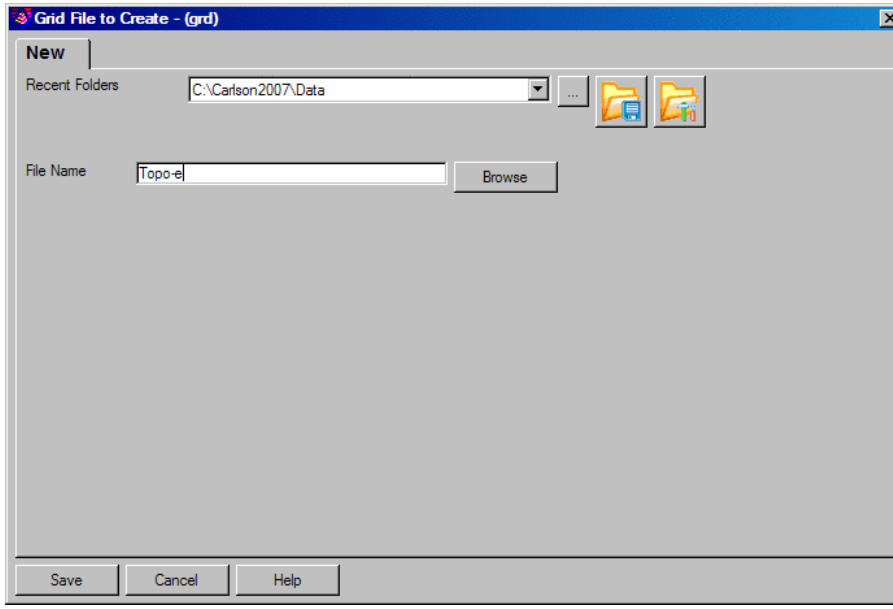
Select contour to edit: *Click on the 1460 contour* (leftmost cursor, shown above)
Pick intermediate point (Enter to end): Click for the new position of the 1460 contour
Pick intermediate point ('U' to Undo,Enter to end): Click a 3rd time
Pick intermediate point ('U' to Undo,Enter to end): Click a 4th time (more if desired you are re-drawing the contour, in effect)
Pick intermediate point ('U' to Undo,Enter to end): *press Enter* before you want to reconnect to the original 1460 as above
Pick reconnection point on contour: *Pick* on the 1460 contour to reconnect
Select contour to edit: Continue on and edit other contours, as desired.

The *Edit Contour* command will keep every edited contour (e.g. our 1460 contour) as a single polyline. The edited segment is auto-joined to the before and after segments. Results below:

5 Draw a Polyline across the Valley, to represent the Centerline of a dam. Choose the Draw pulldown menu, and select *2D Polyline* (near the top of the menu). This is the standard AutoCAD polyline command, the same command you get when you type PL at the command prompt (at the bottom of the screen). Try to split the valley with the polyline (see below).

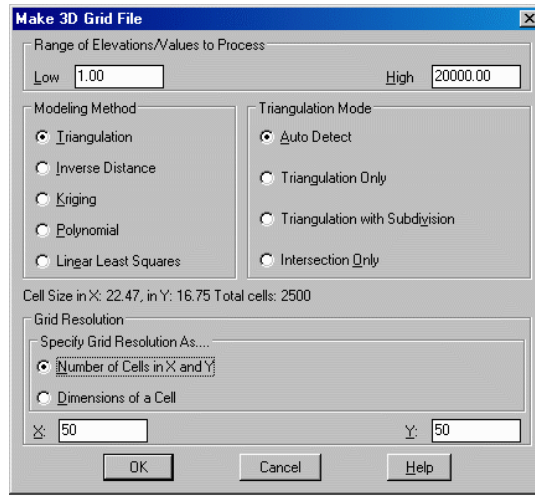
From point: Pick on the left side of the valley.
Current line-width is 0.00
Arc/Close/Halfwidth/Length/Undo/Width/<Endpoint of line>: *Pick on the right side of the valley.*
Arc/Close/Halfwidth/Length/Undo/Width/<Endpoint of line>: *Enter* (for no more vertices)

6 Making Grid Files. A grid file can be used for volumes, comparing one grid to another. While we have the original contours visible, we should save a Topo-e grid file (topo-existing). Select *Make 3D Grid File*, under the Surface pulldown menu. Let's call the original ground grid Topo-e as shown in the dialog here.



Click Save. **Use position from another file or pick grid position [<Pick>/File]?** *Enter*
Pick Lower Left grid corner: Pick to the lower left of the topo area.
Pick Upper Right grid corner: Pick to the upper right of the topo area.

You have just named your grid file and selected the area to grid. This leads to another dialog:



Use the settings shown in this above dialog box (plenty accurate for this application). Click OK.

Select points, lines, polylines and faces to grid from.
Select objects: ALL (again we can use the all selection)
Select objects: *press ENTER* (for no more)

The file Topo-e.grd is then stored.

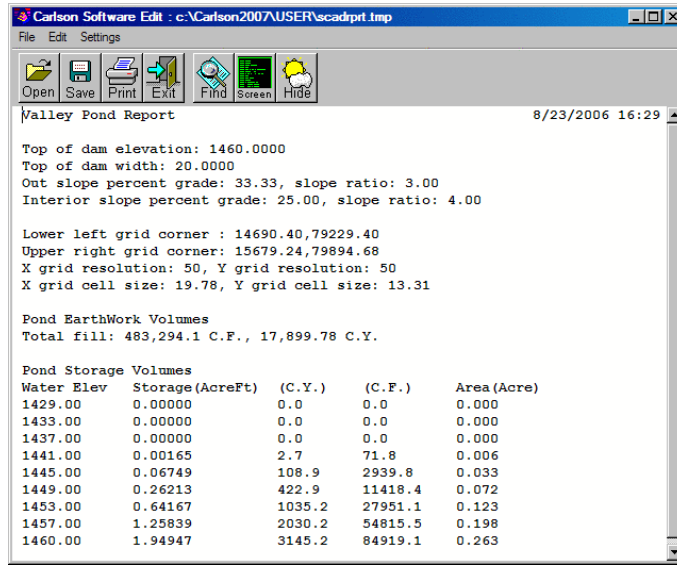
Tip: Whenever you make Carlson files, such as coordinate files (crd), grid files (grd), and even pond capacity files (cap), they store to disk. When you do an AutoCAD Undo command (U for undo), you undo the graphics, but the files are safely stored and are not undone. Carlson does not like to overdo making files. Make them if you want, but we will not make any that are not needed. The entire contouring process, above, was completed without making a single new file, for example, though there were options, clicked off by default, to make files.

7 Design Valley Pond. Select *Design Valley Pond* under the Grading pulldown menu.

Source of surface model [<File>/Screen]? F
Pick the top of dam polyline: Pick the centerline of the dam, as drawn earlier.
Select the grid file Topo-e. Then click Open. If we had no grid file, we could have chosen the screen-select option, and selected all objects.
Pick a point within the pond: *Pick upstream* of the dam centerline
Enter slopes as percent grade or slope ratio [Percent/<Ratio>]? Enter for ratio
Enter the outslope ratio <2.0>: 3
Enter the interior slope ratio <3.0>: 4

Enter the top of dam width <10.0>: 20
Range of existing elevations along dam top: 1421.43 to 1576.42
Enter the top of dam elevation: 1460
Cut pond interior [Yes/<No>]? N
Calculate stage-storage values [<Yes>/No]? Y
Method to specify storage elevations [<Automatic>/Interval/Manual]? *press Enter*
Output grid file of final pond surface [Yes/<No>]? Y
Save the surface, that includes the pond, in the file Topo-d for Topo with dam.

The following report includes earthwork volumes and water storage volumes.


Carlson Software Edit : c:\Carlson2007\USER\scadrpt.tmp
File Edit Settings
Open Save Print Exit Find Screen Hide
Valley Pond Report 8/23/2006 16:29
Top of dam elevation: 1460.0000
Top of dam width: 20.0000
Out slope percent grade: 33.33, slope ratio: 3.00
Interior slope percent grade: 25.00, slope ratio: 4.00
Lower left grid corner : 14690.40,79229.40
Upper right grid corner: 15679.24,79894.68
X grid resolution: 50, Y grid resolution: 50
X grid cell size: 19.78, Y grid cell size: 13.31
Pond EarthWork Volumes
Total fill: 483,294.1 C.F., 17,899.78 C.Y.
Pond Storage Volumes
Water Elev Storage(AcreFt) (C.Y.) (C.F.) Area(Acre)
1429.00 0.00000 0.0 0.0 0.000
1433.00 0.00000 0.0 0.0 0.000
1437.00 0.00000 0.0 0.0 0.000
1441.00 0.00165 2.7 71.8 0.006
1445.00 0.06749 108.9 2939.8 0.033
1449.00 0.26213 422.9 11418.4 0.072
1453.00 0.64167 1035.2 27951.1 0.123
1457.00 1.25839 2030.2 54815.5 0.198
1460.00 1.94947 3145.2 84919.1 0.263

Click the Exit icon to continue forward in the process.

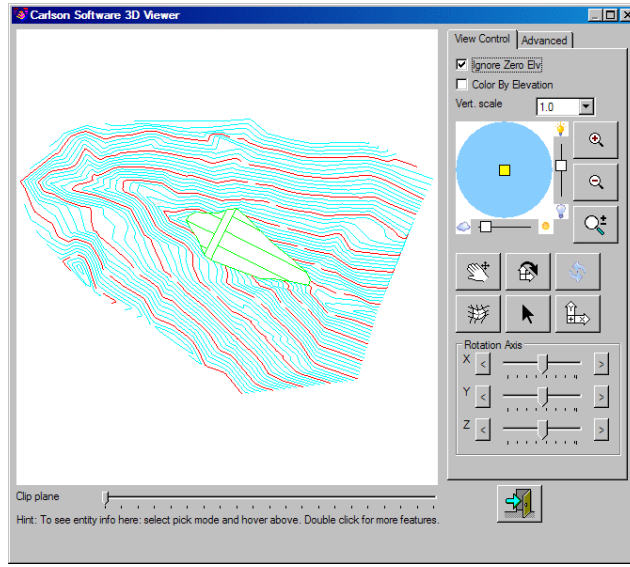
Write stage-storage to SEDCAD file [Yes/<No>]? Y
Save the pond stage-storage curve file (in SEDCAD format) in a file. Choose any name. Click Save.
Adjust parameters and redesign pond [Yes/<No>]? N
Trim existing contours inside pond perimeter [Yes/<No>]? Y
Retain trimmed polyline segments [Yes/<No>]? N
Contour the pond [<Yes>/No]? N

The process is complete. At the command line, enter E for erase and then when it says Select objects:, pick on the centerline of the dam, then Enter for no more picks, and the centerline will erase.

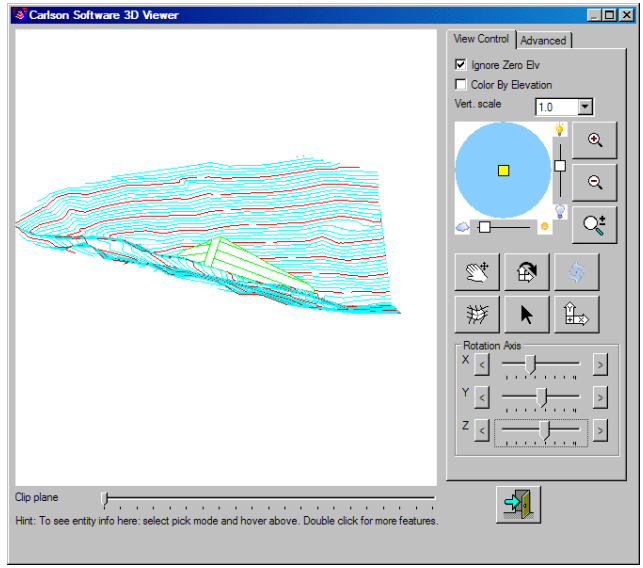
Tips: The stage-storage curve that you save will plot in the Carlson Hydrology program. It makes a nice, handy plot for report purposes. See Lesson 11. Also, it's always good to save your drawing periodically.

8 Check it out in 3D. Select the *3D Viewer Window* option, under the View pulldown.
Select all entities for the scene.
Select objects: ALL (again, we use the all selection)
Select objects: *press ENTER* for no more

This leads to the starter view (a plan view) shown below:



The main trick is to move the X-Axis bar to the left. Avoid the Y-Axis dial for now, and then grip on the Z-Axis dial and move it back and forth relatively fast, or just click on the Z-Axis arrows and watch things move slower. Its like you are in a helicopter over the site. Here's an example:



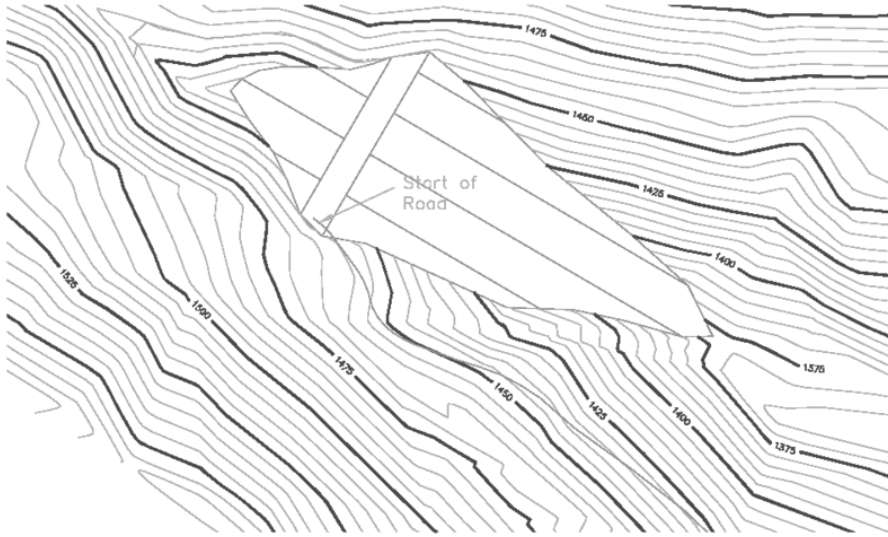
9 Exit the 3D Viewer. Now choose *3D Polyline by Slope on Surface*, found under the 3D Data menu.

Enter the polyline layer <SLOPE_PLINE>: *press Enter* (to accept this)
Now select the grid file (this routine expects a grid). The file is Topo-d.
Pick origin point of 3D polyline: *Pick a point* on the south side of the top of the dam, just before it contacts the ground.
Direction of 3D polyline [<Up>/Down]? D
Direction of 3D polyline facing down slope [<Left>/Right]? R
Slope format [<Percent>/Ratio/Degree]: *press Enter*
Enter design slope percent: 10

Your information should be similar to this:

```
 Horizontal distance: 693.65, Slope distance: 697.12
Vertical drop: 69.41, Avg slope: 10.01%, Max slope: 10.06%
```

Pick origin point of 3D polyline (Enter to end): *press Enter* (no more)



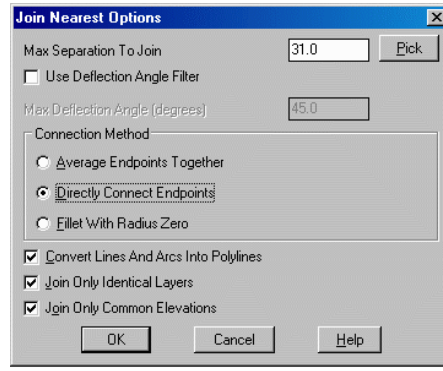
This created a smooth, 10% downhill grade 3D polyline, as shown, which we can use to construct a maintenance road up to the dam.

10 Offset 3D Polyline. This is a Carlson specialty, a high-powered Civil Design feature. In short, you can work in 3D because you can offset and manipulate 3D polylines using Carlson. So Select *Offset 3D Polyline*, under 3D Data.

Enter the offset method [<Interval>,Constant,Variable]: *press Enter*
Vertical/<Horizontal offset amount>: 30 (for a 30' wide road)
Percent/Ratio/Vertical offset amount <0>: *press Enter*
Select a polyline to offset (Enter for none): *Pick our new 3D polyline*
Select side to offset: *Pick* into the hill, to the left or SW
Select a polyline to offset (Enter for none): *press Enter* (for no more)

This creates the other side of the road parallel, but not joined yet. For that we use use *Join Nearest*.

11 Select *Join Nearest* under the Edit pulldown menu. A dialog appears, which you need to fill out as follows:



The most important aspect is to click Directly Connect Endpoints, and tolerate the fact that they are 30' apart by allowing for a Max separation to join of 31. That way, they will join! Click OK.

Select lines, arcs and unclosed polylines to join. *Pick both sides* of the road, one at a time, carefully avoiding picking a contour. If both the edge of roads are picked and highlighted, hit Enter to avoid additional selections.

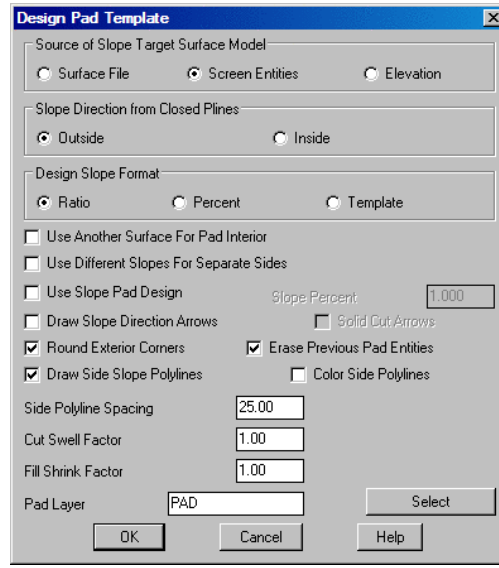
If a contour is picked, press ESC to exit the command and start over, or press R for remove, pick it to remove it from the selection set, then A to Add, and pick again on the road.

Tip: This is obvious, but where it is difficult to pick what you want, because several objects are nearby or overtop what you want, it pays to do View, Window and zoom in closer, followed by View, Previous after you are done.

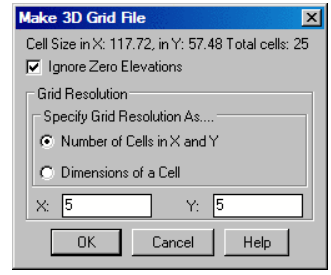
We have a road, or at least a sloping pad, seen below:

12 Pad Template is one of the more diverse and powerful commands in Carlson. We will use it here to make a simple cut and fill slope from our road pad. We will go 0.5:1 in cut, but 1:1 in fill. You might think a 2:1 in fill is better, but remember, our hillside edge of road (the original edge) follows very closely to the hill itself, as designed. If it cantilevers out a few inches, and the natural slope of the ground is 1.5:1 (which it is!), 2:1 will never catch, and we will create big fill areas. So we will go with 1:1 in fill, and get very tiny, quick tie-ins in those few cases where there is any fill at all.

Pick *Design Pad Template*, a command under the Grading menu. A dialog appears. Use the standard entries, as shown below:



Click OK. Pick two limit points of pad disturbed area. Another dialog appears. Make sure the entries match what is below.



Click OK.

Pick the pad polyline: *Pick the road pad*
Select the Topo-d.grd file. *Click Open.*
Enter the fill outslope ratio <2.0>: 1
Enter the cut outslope ratio <1.0>: 0.5
Calculate earthwork volumes [<Yes>/No]? Y

Store to the file Topo-f,for Topo final. (A report is produced similar to Valley Pond. Review and Exit it).
Adjust parameters and redesign pad [Yes/<No>]? N
Write final surface to grid file [Yes/<No>]? Y
Trim existing contours inside pad perimeter [Yes/<No>]? Y
Retain trimmed polyline segments [Yes/<No>]? N
Contour the pad [<Yes>/No]: N

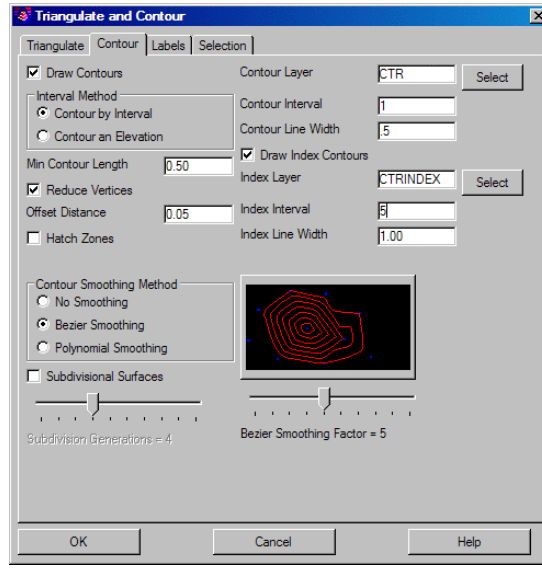
This completes the Lesson 6 tutorial: Contouring, DTM and Design.

Lesson 7: Contouring, Break Lines and Stockpiles

1 Click the icon for Carlson and start-up AutoCAD/Carlson from Windows.

2 Once in Carlson, exit out of the Startup Wizard (if it appears) and click *Open* under the File pulldown menu. Look for the file Mantopo.dwg and click on it.

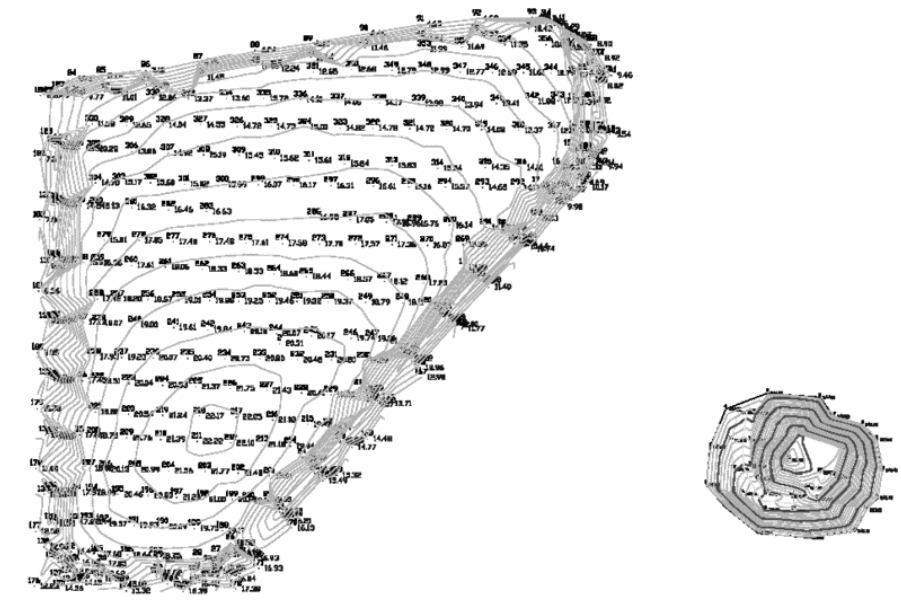
3 Select *Triangulate & Contour* from the Surface pulldown menu (within the Survey module). Click the Contour tab. Let's target contours at a 1-unit interval, and contour the area of points. You will see this dialog:



Make all settings as shown (most of them are the default). We want to make sure that the Contour

Interval (top right) is set to 1. Also, be sure to set the Index Interval to 5. Click OK.

Select the points and breaklines to Triangulate.
Select objects: Do a bottom right to upper left crossing selection by picking just to the left of the small, stockpile contour map, near the bottom of the screen, and then picking the upper left of the screen (capturing all points).
Select objects: *Enter*(for no more)
A dialog box appears. Select Mantopo.crd as your crd file. Click Open and the points will be read from the crd file.
Range of Point Numbers to use [<All>/Group]: *Enter* (to accept All)
Wildcard match of point description <*>: *Enter*
Contours are drawn, but notice the unacceptable wavy look around the perimeter an area which is meant to be a ditch.

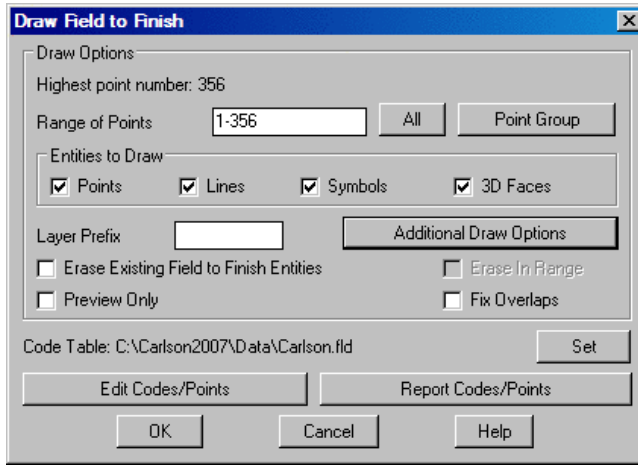


Type in U for Undo and press Enter until the new contours (at left) disappear and you are back at the command prompt.

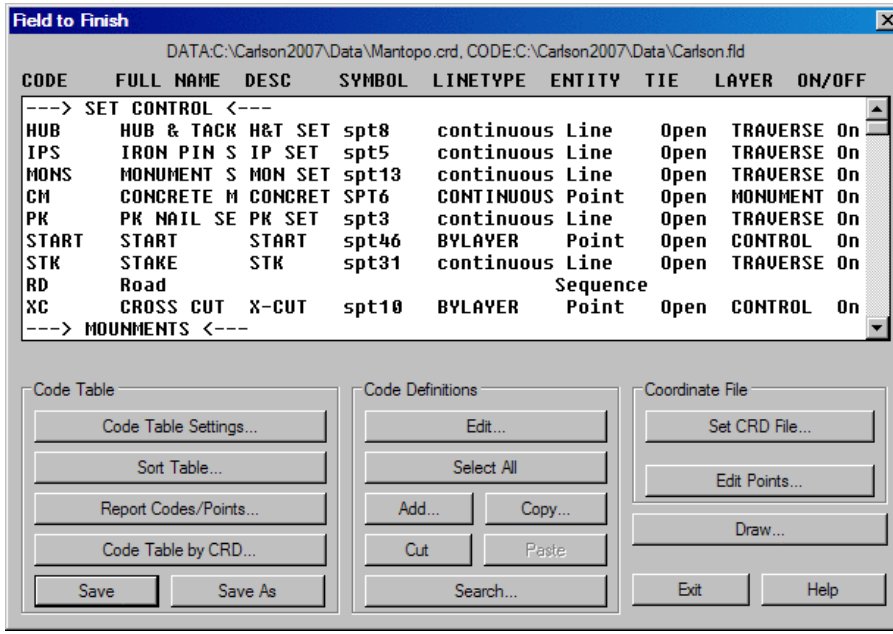
4 Field-to-Finish: From within the Survey module, under the Survey pulldown menu, select *Draw Field-to-Finish*.

You will be prompted for the CRD file to process. Choose the Existing tab, then select MANTOPO.CRD, which resides in Carlson's data folder, and click Open. The Draw Field to Finish

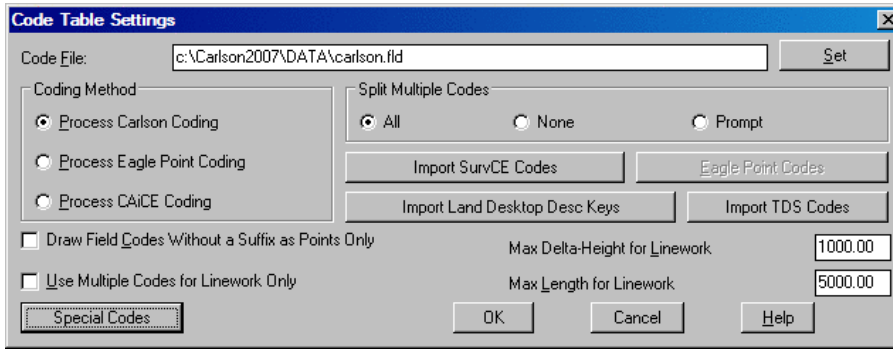
dialog appears.



At the lower left of the Draw Field to Finish dialog, click Edit Codes/Points. The Field to Finish dialog appears.

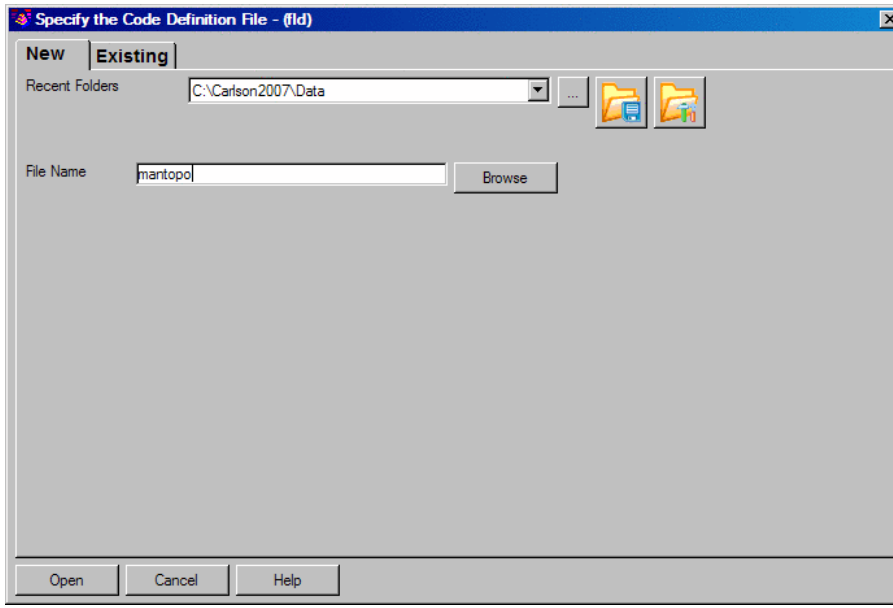

Field to Finish
DATA:C:\Carlson2007\Data\Mantopo.crd, CODE:C:\Carlson2007\Data\Carlson.fld
CODE FULL NAME DESC SYMBOL LINETYPE ENTITY TIE LAYER ON/OFF
---> SET CONTROL <---
HUB HUB & TACK H&T SET spt8 continuous Line Open TRAVERSE On
IPS IRON PIN S IP SET spt5 continuous Line Open TRAVERSE On
MONS MONUMENT S MON SET spt13 continuous Line Open TRAVERSE On
CM CONCRETE M CONCRET SPT6 CONTINUOUS Point Open MONUMENT On
PK PK NAIL SE PK SET spt3 continuous Line Open TRAVERSE On
START START START spt46 BYLAYER Point Open CONTROL On
STK STAKE STK spt31 continuous Line Open TRAVERSE On
RD Road Sequence
XC CROSS CUT X-CUT spt10 BYLAYER Point Open CONTROL On
---> MOUNMENTS <---
Code Table
Code Table Settings...
Sort Table...
Report Codes/Points...
Code Table by CRD...
Save
Save As
Code Definitions
Edit...
Select All
Add...
Copy...
Cut
Paste
Search...
Coordinate File
Set CRD File...
Edit Points...
Draw...
Exit
Help

On the left side of the Field to Finish dialog, under the heading Code Table, there is an option called Code Table Settings. Click on it. You will see this dialog:

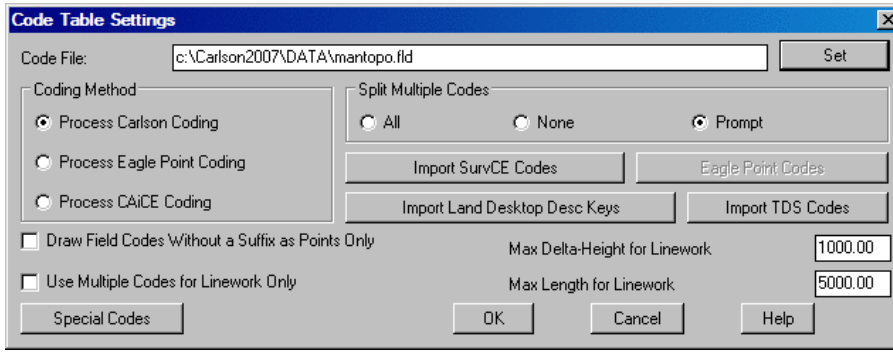


As you can see at the top of the Code Table Settings dialog, the default Field to Finish code definition (.FLD) file is Carlson.fld. We want to make a new code table because the coordinate file for the field survey includes special coding (17 and 18) for ditch lines and top of banks.

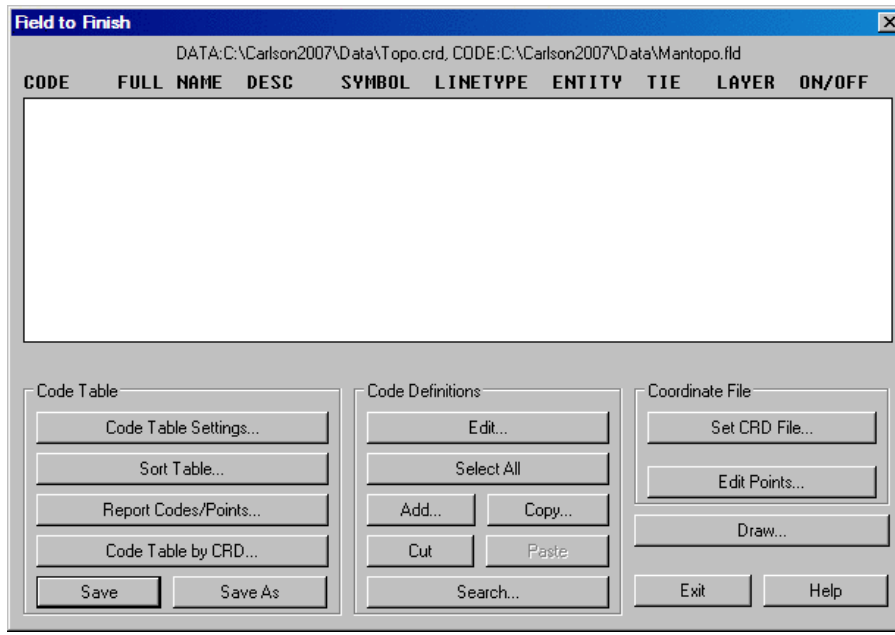
You can react and adjust to whatever a field crew uses by making a new field-to-finish table that can load up the codes right from whatever descriptions were used in the field. To do this, click Set at the upper-right of the Code Table Settings dialog, then choose the New tab (for new file) and you might name it Mantopo, as shown below:



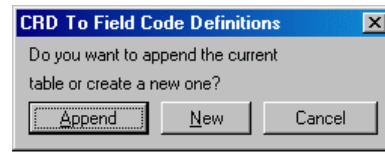
Click Open. You will be taken to the previous dialog.



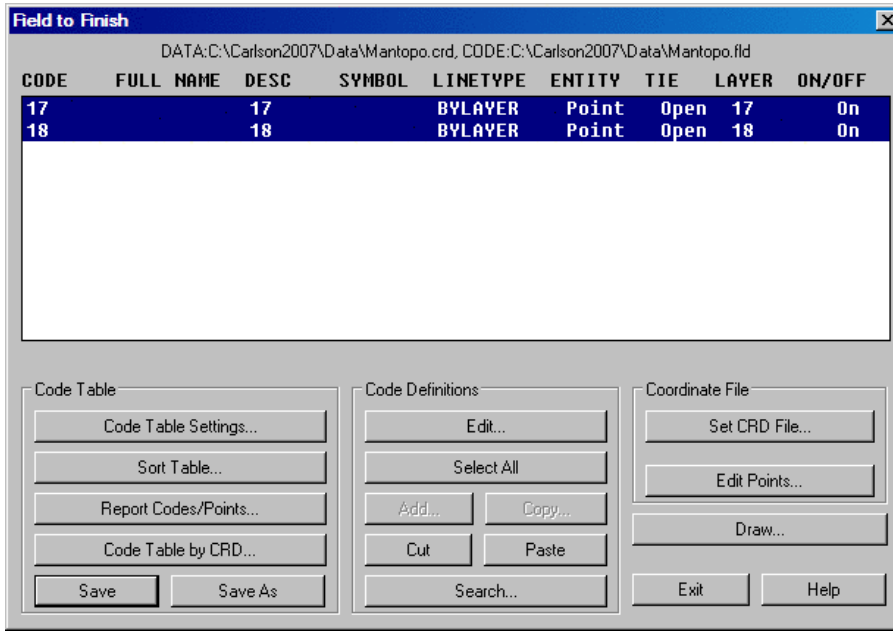
Notice how \DATA\Mantopo.fld is now listed at the top. Click OK. You will return to the main Field to Finish table, completely empty, as shown below:



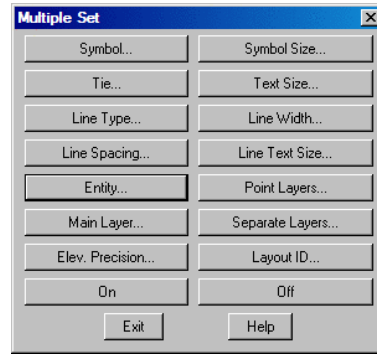
Now, jump start the table by choosing the option Code Table by CRD (located in the lower left of the dialog). Choose Append.



In this lesson, we only care about code 17 and 18, so highlight all of the others (by holding the CTRL key down and picking them), then choose Cut. Now highlight both 17 and 18 as shown below.

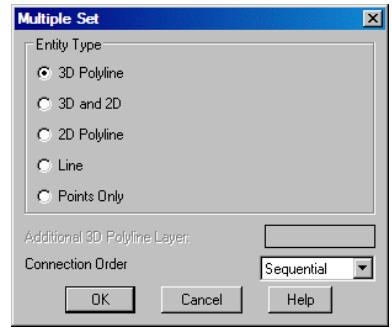


Pick the middle Edit button. Another dialog appears.

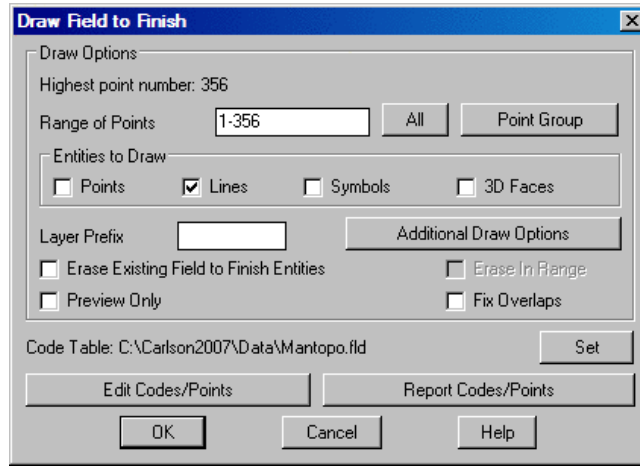


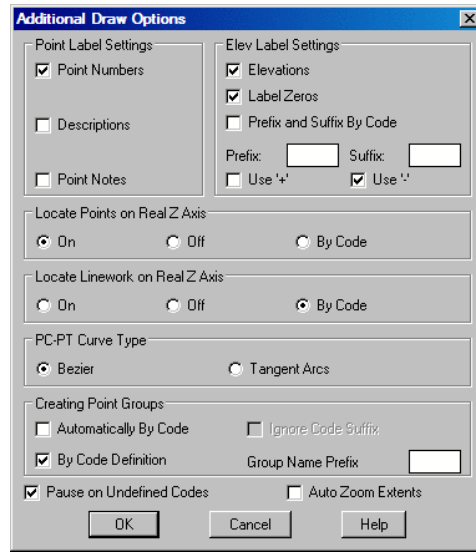
Click the Entity button for yet another dialog, shown below. Make all settings as shown in this box. We will turn them both into 3D polylines (which will act as break lines or barrier lines for contouring). Accept the 3D Polyline choice by clicking OK, then hit Exit, which will take you

back to the Field to Finish dialog.

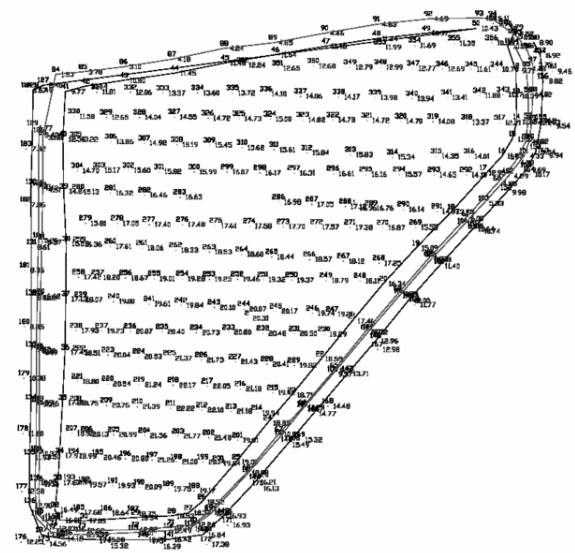


The last steps are to first to save the Field-to-Finish (.FLD) file Mantopo by clicking the Save button. Then click Draw (lower right) to draw the 3D polylines. You will see the following dialog which allows you to control the details of what to draw. Make sure lines is the only entity to be drawn, not points or symbols. Take a quick look at Additional Draw Options by clicking that button. Make sure that the Point Label Settings are set so that you can see the points properly. Click OK to both dialog boxes.





The following drawing is created. All the ditch lines and top of bank lines, because they were coded 17 and 18, are drawn in one quick procedure.



5 Because the field crew did not use start and stop logic (e.g. appending 7 or some agreed upon

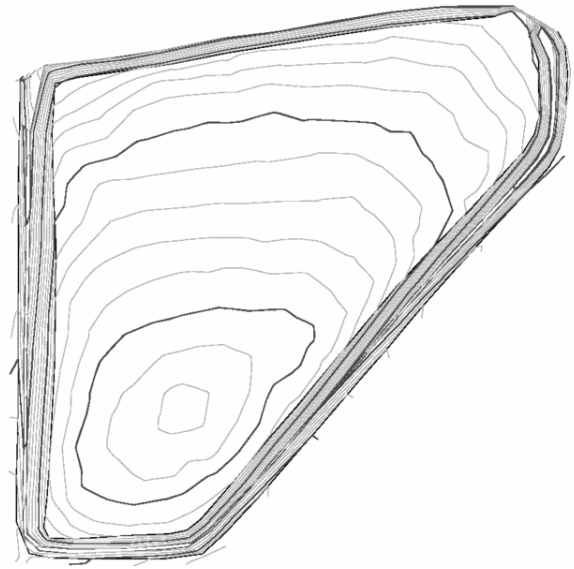
code to a description could end a polyline and start another), some polylines connect that should not. In particular, the line pointed to near the NW corner is clearly crossing the ditch line. It must be removed. Choose the Edit pulldown, then *Polyline Utilities*, *Remove Polyline*, then *Remove Polyline Segment*.

Break polyline at removal or keep continuous [<Break>/Continuous]? *Enter*
Select polyline segment to remove: *Select the polyline segment* to the right of point 127. You will recognize this as a long segment running from point 127 to point 50.
Select polyline segment to remove: *Enter(*for no more)

6 Return back up to the Surface Menu, pick *Triangulate & Contour*, and set the standard contour interval to 1 (as before), but specify Draw Index Contours. Set the index interval to 5. Then do a right-to-left crossing selection as before (avoiding the stockpile at the lower right). Select the Mantopo.crd file again.

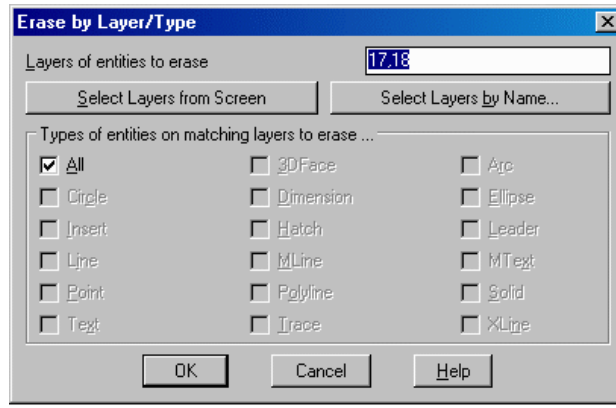
Now we get excellent contours, with a sharply defined ditch. Under View, do *Freeze Layer* and pick on a point. The points will freeze.

Here is the improved drawing, helped out by 3D polylines, which, if selected, act as break lines, which were produced by *Draw Field-to-Finish*.



7 Delete Layer. Let's say that now you don't want the break lines on there. You don't want to even freeze them, you want to fully delete them. There is a command for that under Edit. Pick *Erase*,

sliding over to *Erase by Layer*. This dialog appears.



If you know the layer names, you can just type them in. If you know where they are but not their names, then click on Select Layers from Screen. If you'd recognize the layer name if you saw it in a list, click Select Layers by Name. Click on Select Layers by Name and pick 17 and 18, then OK twice. Notice the change in the drawing.

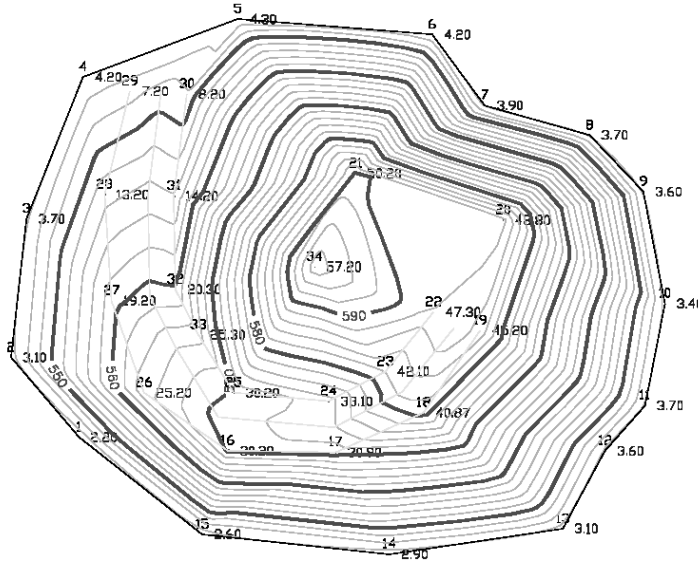
8 Explode. Inserted Drawings need to be exploded. Do a View pulldown, option *Window* and window in on the stockpile at the lower right of the drawing. If you type E to Erase, and try to erase any aspect of the stockpile, the whole stockpile will erase all features. That is because the Stockpile was another drawing inserted into this drawing. Sometimes other drawings that are inserted are referred to as Blocks. In any case, this stockpile block, or inserted drawing, needs to be exploded. Explode just breaks it up into its unit objects which then start to behave normally. Select Explode under Edit and slide over to Standard Explode. Then pick the stockpile. It is now a set of normal objects.

It's also worth noting that while the block has been exploded, it still exists in the drawing as a block definition. This means that now that it's exploded it is taking up twice the amount of storage space in the drawing. As such, you should purge the drawing of the unused block, or turn on the explode toggle when inserting one drawing into another. As a basic rule, if it's a symbol, don't turn on the explode toggle; if it's a complete dialog, turn it on.

9 Change Elevations. Let's assume our stockpile drawing is too high and should be lowered in elevations by 540 units. To best see the effect of this command, bring back the points by selecting *Thaw Layer,* under View. Now select the Edit pulldown, then *Change*, then *Elevations*.

Ignore zero elevations [<Yes>/No]? *Enter*
Type of elevation change [Absolute/<Differential>]: D
Change Layer for changed entities [Yes/<No>]: *Enter*
Positive number increases, negative number decreases elevation.
Scale/Elevation difference <0.00>: -540
Hit Enter twice.
Select objects: Do a lower right pick to upper left pick (automatic crossing) selection.
Select objects: *Enter* (for no more)

Notice in the drawing below how everything has change elevation, including the points, but with the exception of the contour text.



Do the command *List Elevation* under the Inquiry pulldown, pick on an index contour, and notice how the elevation has indeed changed. Repeat step 7 and delete the layer Ctext, so as to remove the 5 index contour elevations, which are no longer accurate.

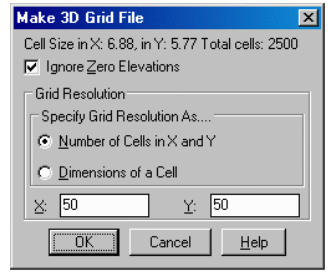
10 Volumes by Layer. One of the signature commands of Carlson, *Volumes by Layer* will produce accurate volumes without making any files. The only prerequisite is that the existing and final surfaces exist on the drawing in separate, distinct layers. It is also very important to have a drawn inclusion perimeter to pick and define where the volumes are being calculated. In our example, the original ground will be the 3D polyline connecting points 1 through 15, and everything else above will be the final ground (including the 3D perimeter itself).

Select *Volumes by Layers*. This command is found under the Grading menu, within *Volumes by*

Grid Surface.

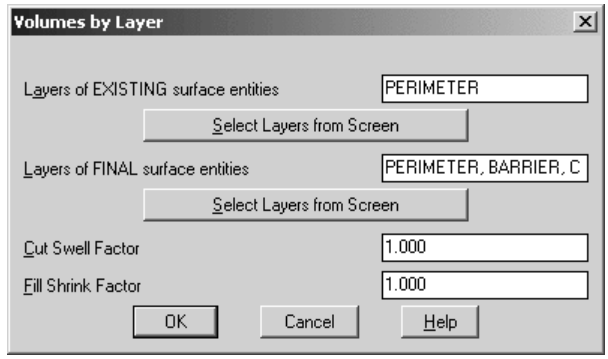
Pick Lower Left limit of surface area: *Pick below and to the left* of the stockpile, but as close as possible to the stockpile without clipping it in the window. You want to totally include it, but with little wasted margin.
Pick Upper Right limit of surface area: *Pick above and to the right* of the stockpile.

A dialog appears:



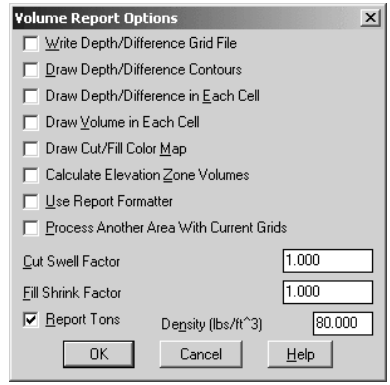
We will stick with the defaults, as shown. Notice that we are using 50 grid cells within our window, and since our window was not a perfect square, the cell sizes are not whole numbers. (In this example it is 6.88 x 5.77. You my have slightly different sizes). Seeing this, if we wanted 5 x 5 cell size, we could click the Dimensions of a Cell option and set the size to 5 x 5. Hundreds or thousands of cells in both directions will increase calculation time. You can experiment with more cells, or if you prefer, smaller cells (which makes more cells), and see when you get diminishing returns in terms of accuracy changes. After a while, tighter, smaller cell sizes don't add any value to the precision of the calculation. Click OK.

Then pick the layers that define the existing ground (Perimeter) and the layers that define the final ground (Perimeter, Barrier, Ctr, Ctrindex).



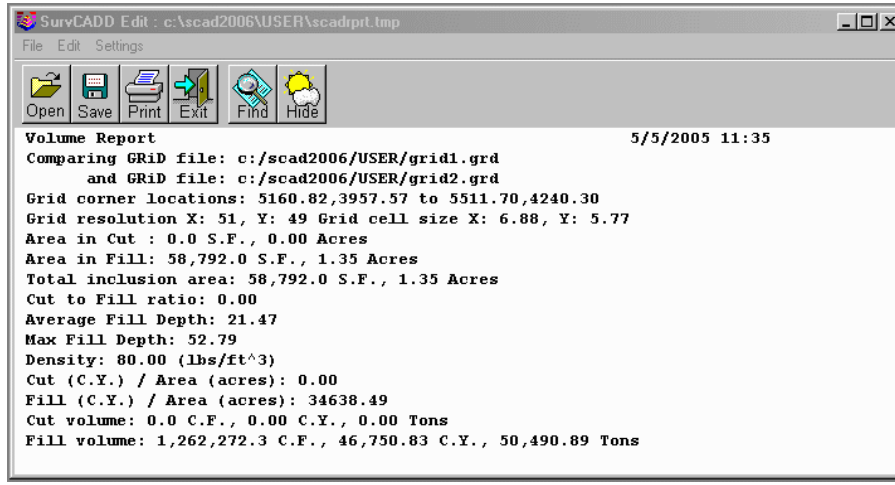
Then click OK. Notice how the Perimeter layer is common to both. If you want to be a master of volumes, remember this as a mantra: The perimeter should be a 3D polyline in a distinct layer, common to both surfaces. A stockpile is just a special case in that sometimes the 3D perimeter is all you know about the base surface.

When asked to Select objects, do a right-to-left (crossing) selection of the entire stockpile area. Lastly, you will be asked for the inclusion perimeter (pick the white perimeter polyline) and the exclusion perimeter (none). This leads to a flexible reporting and output dialog:



Elevation Zone Volumes, for example, would produce volumes in any desired increment from the base of the stockpile going up. If the stockpile consists of coal (80 lbs/c.f.), then Report Tons can be clicked on and a Density value entered.

Click OK, and the basic report is produced, as seen below. We did not include the points in the final layer. Since there is a high point, for example, the top of the stockpile, the points would lift the volumes up slightly.


SurvCADD Edit : c:\scad2006\USER\scadrprt.tmp
File Edit Settings
Open
Save
Print
Exit
Find
Hide
Volume Report 5/5/2005 11:35
Comparing GRiD file: c:/scad2006/USER/grid1.grd
and GRiD file: c:/scad2006/USER/grid2.grd
Grid corner locations: 5160.82,3957.57 to 5511.70,4240.30
Grid resolution X: 51, Y: 49 Grid cell size X: 6.88, Y: 5.77
Area in Cut : 0.0 S.F., 0.00 Acres
Area in Fill: 58,792.0 S.F., 1.35 Acres
Total inclusion area: 58,792.0 S.F., 1.35 Acres
Cut to Fill ratio: 0.00
Average Fill Depth: 21.47
Max Fill Depth: 52.79
Density: 80.00 (lbs/ft^3)
Cut (C.Y.) / Area (acres): 0.00
Fill (C.Y.) / Area (acres): 34638.49
Cut volume: 0.0 C.F., 0.00 C.Y., 0.00 Tons
Fill volume: 1,262,272.3 C.F., 46,750.83 C.Y., 50,490.89 Tons

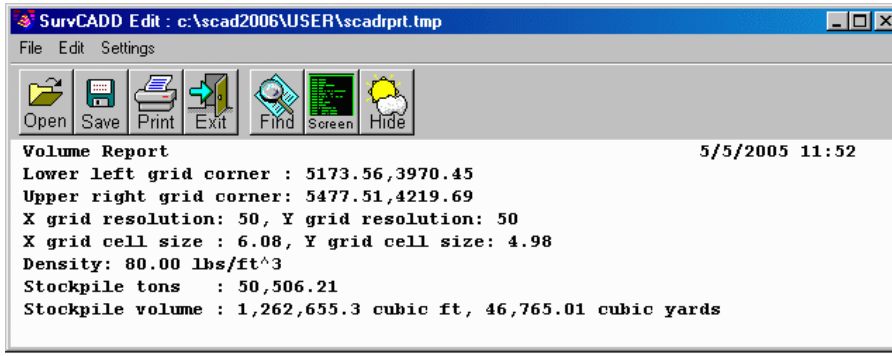
Click the Exit icon to return to the command prompt.

11 Stockpile Volumes. Our Stockpile is naturally well-suited for applying the simplest volume command of all Stockpile Volumes. It requires that the 3D perimeter polyline for the stockpile be placed in a layer called Perimeter which ours is. So let's try it.

Select *Calculate Stockpile Volume* found under the Grading pulldown menu.

Material density lbs/ftˆ3 (Enter for none): 80
Ignore zero elevations [<Yes>/No]? *Enter*
Reading points ...
Select Stockpile perimeter polyline: *Crossing select (right-to-left picks)* the entire stockpile area.

The grid resolution dialog (note that it is still at 50x50) appears again. Click OK. Done. A report is generated.


SurvCADD Edit : c:\scad2006\USER\scadrprt.tmp
File Edit Settings
Open Save Print Exit Find Screen Hide
Volume Report 5/5/2005 11:52
Lower left grid corner : 5173.56,3970.45
Upper right grid corner: 5477.51,4219.69
X grid resolution: 50, Y grid resolution: 50
X grid cell size : 6.08, Y grid cell size: 4.98
Density: 80.00 lbs/ft^3
Stockpile tons : 50,506.21
Stockpile volume : 1,262,655.3 cubic ft, 46,765.01 cubic yards

This completes the Lesson 7 tutorial: Contouring, Break Lines and Stockpiles.

Lesson 8: A Dozen Tools for Surface Design

Tool 1 - Pad Template

Tool 2 - Draw 3D Polyline

Tool 3 - Offset 3D Polyline

Tool 4 - Join Nearest

Tool 5 - Bench Pond

Tool 6 - Valley Pond

Tool 7 - 3D Polyline by Slope on Surface

Tool 8 - 2D to 3D Polyline by Surface Model

Tool 9 - Input-Edit Profile

Tool 10 - Profile to 3D Polyline

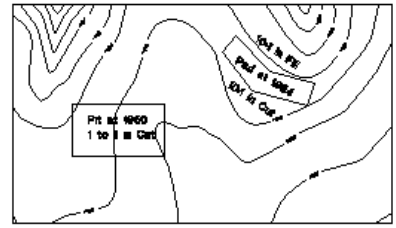
Tool 11 - Design Template

Tool 12 - Break 3D Polyline by Surface Model

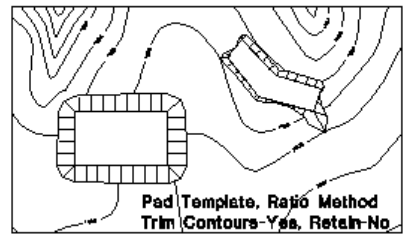
I. Pad Template (Tools 1-4)

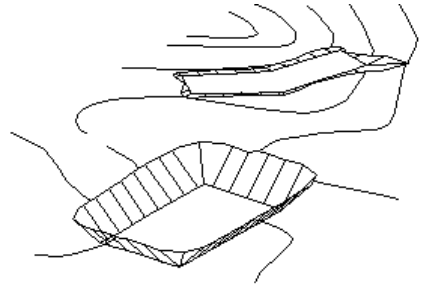
A. 2D Polyline Closed Perimeter

The most basic use of a pad template is for the creation of flat-bottomed pits and flat "building pads", at any desired elevation. The procedure is simply to draw a closed polyline at 0 elevation, then select *Design Pad Template*, found in the Grading pulldown menu, and enter the side slopes and pad elevation. See the two polyline examples shown here.



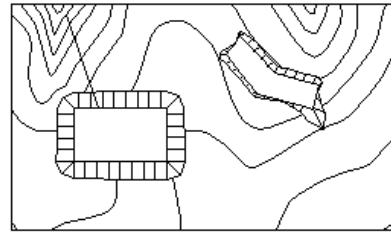
This piece of the larger drawing was carved out by first doing the *Rectang* command, and making a rectangular polyline as shown above. Then we did *Break by Crossing Polyline*, under the Edit pulldown, using default answers, followed by *Write Block*, to write out the separate drawing. The two polylines are drawn by the *Rectang* command for the pit, and the PL command at 0 elevation for the pad.

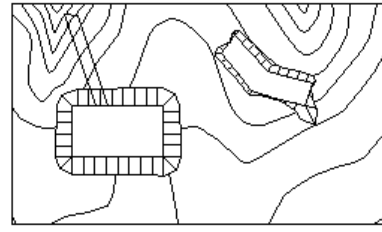




B. Draw 3D Polyline

This is an obvious tool for creating terrains. We recommend use of Carlson's *3D Polyline*, found near the top of the Draw pulldown menu. Our first exercise is to build a ramp from north to south into the pit. We will "arbitrarily" start at elevation 1978 by "snapping" to the 1978 contour with the "nea" snap (nearest), then snap to the base of the pit at 1950 with the nearest snap. Then we will offset this 3D Polyline, connect its ends by *Join Nearest*, and do a pad template at 2:1 sideslopes. As an exercise, try *Viewpoint 3D* under the View pulldown, and choose a SW viewing angle at 35 degrees above the XY plane to get a view similar to the 3D graphic shown. In this view, erase the original pad base polyline, which is still at 0 elevation. This will prevent the "nea" snap from finding the 0 elevation base polyline instead of the new, green, pad polyline. Enter Plan at the command prompt, followed by two Enters, to go back to Plan View.





C. Offset 3D Polyline

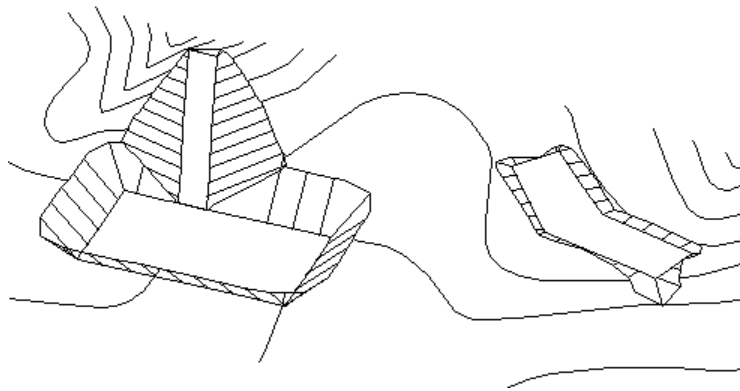
After the 3D Polyline is drawn, do the Inquiry command *Bearing & 3D Distance*, Linework option, to check the percent slope of the 3D polyline. At approximately 10% grade, it should be "drivable" by haul trucks. Move the second 3D Polyline to contact the base of pit.

D. Join Nearest

Now find *Join Nearest,* under the Edit pulldown menu. Select Directly Connect Endpoints, and enter a 35 offset tolerance. Pick both 3D polylines to join them, as shown in the graphic.

E. 3D Polyline Closed Perimeter

Now we have a 3D polyline closed perimeter, which can act as a pad. Within the *Design Pad Template* routine, we will no longer be asked for a pad elevation, since the program will obtain the variable pad elevation from the vertices of the 3D polyline. It is advisable to first do a *List* command, under Inquiry, to verify that each pad vertex is non-zero. The 2:1 cut side slopes (fill sideslope is irrelevant, since we are in cut) leads to the drawing shown in the graphic.

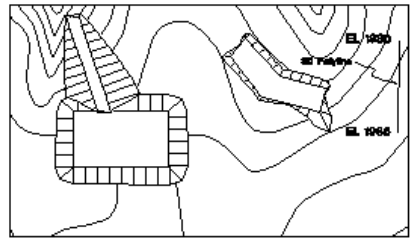


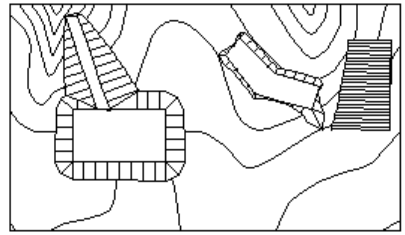
Note that we are consistently using *Design Pad Template* to trim existing contours and 3D polylines, and to not retain the trimmed portion. We are also consistently selecting not to draw contours. In this manner, we iterate our way to the desired final terrain. We should also note that we are using the standard 50x50 "number" of cells in the Pad Template routine, windowing the entire site each time. More cells or smaller dimensioned cells leads to a finer calculation.

F. One-Sided Pad Template

Design Pad Template also works with a 2D or 3D polyline that is open and not closed. In this case, the routine will ask for which side to offset (with a closed polyline, it always offsets outward). For example, suppose you were concerned where a pit located along the northeast side

of the site would "catch" if it sloped at 2:1 from an elevation varying from 1980 at the north end to 1985 at the south end. To put this 3D Polyline in, select *3D Polyline* under the Draw pulldown menu, and choose the prompt for elevation option. Enter the north elevation as 1980 and the south elevation as 1985. Then do Pad Template and choose the left side for the offset at 10:1.





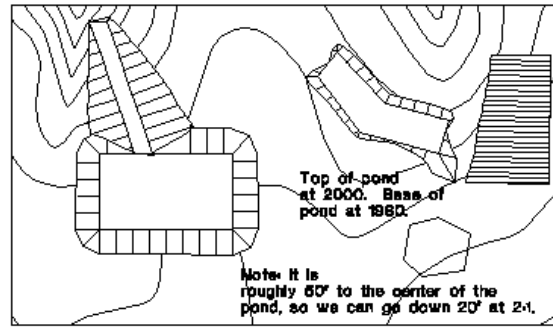
The top of the cut did not impact the building pad or the parking lot.

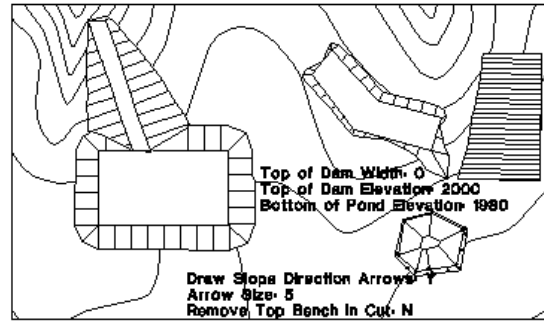
II. Bench Pond (Tool 5)

A. Fully "Incised" Pond

The *Design Bench Pond* routine is found under the Grading pulldown menu. It is based on the use of a closed polyline representing the top of the pond. The program cuts a circular pond into the existing terrain. Unlike *Design Pad Template*, the *Design Bench Pond* routine works "inward". The main thing to remember is that if you have roughly 20 feet to the center of the pond, and you want to go downward at 2:1, do not ask for a depth greater than 10 feet. This will cause one side to pass beyond the other, and you will "hourglass" the interior. Another concept to remember is that the program will cut downward from the drawn polyline, which is placed at an elevation representing the water level or top of pond. A separate cut and fill ratio can be applied to the outside of the drawn polyline. If you place the pond fully in cut (fully incised), then one cut ratio would apply to the interior going down to the base of pond, and another would apply to the exterior going up to "daylight". Of course, the same ratio can be entered for both slopes. Here

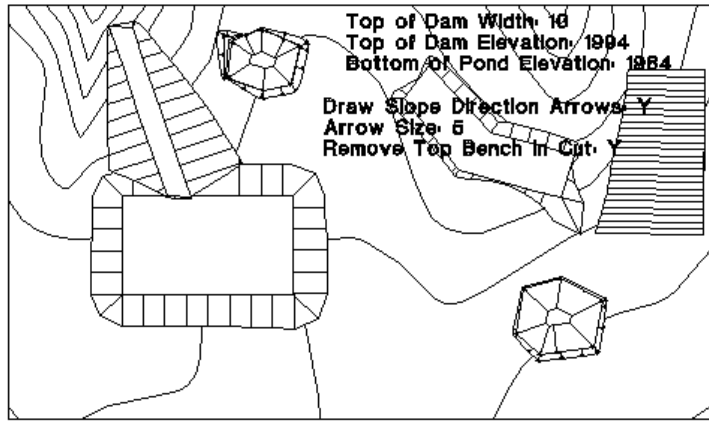
we have drawn a closed polyline in the lower right of the drawing, and will set its elevation to the lowest elevation the line crosses (as prompted by the program). This will ensure that the pond is fully incised and does not have any fill slopes.




Top of Dam Width: 0
Top of Dam Elevation: 2000
Bottom of Pond Elevation: 1980
Draw Slope Direction Arrows: Y
Arrow Size: 5
Remove Top Bench in Cut: N

B. Partial Fill-Partial Cut Bench Pond

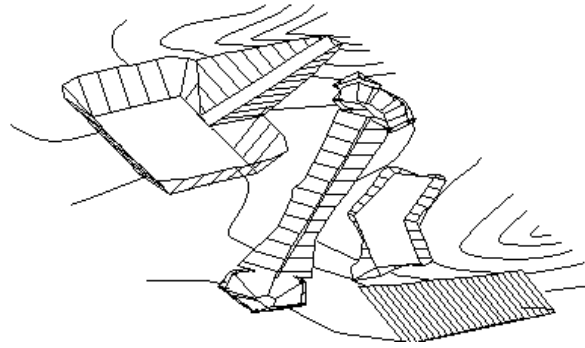
A typical farm pond might have the downhill side in fill and the uphill side in cut. In fill, the flat-topped "bench" might be 10 feet. In cut, the bench would disappear. Cut above water into original ground might be 6:1. Cut below water might be 3:1. Fill could be set at 6:1 and 3: below water. In this case, we would remove the top bench in cut. The graphic shown is a bench pond cut into the top center of the drawing at elevation 1994.


Top of Dam Width: 10
Top of Dam Elevation: 1994
Bottom of Pond Elevation: 1984
Draw Slope Direction Arrows: Y
Arrow Size: 5
Remove Top Bench In Cut: Y

C. Revisit Pad Template by Doing a Diversion Ditch

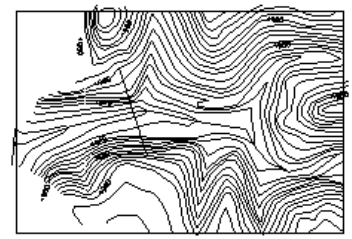
If you are getting the idea, try this on your own: Draw a 3D Polyline that will drain the lower right pond into the upper left pond. Do this through use of the *3D Polyline* command, under Draw. Issue the command, and do a "nea" snap maybe one-third down the northwest "slope direction line" in the pond at the lower right of the graphic. Connect with a "nea" snap to a point halfway down the southeast running "slope direction line" in the pond at the upper left of the graphic. List your 3D polyline to be sure it runs downhill from approximately 1992 to 1989, or thereabouts. We're after the concept here. Then do *Offset 3D Polyline* four feet either way for base of ditch. Connect the ends up with Join Nearest, tolerating 5' separation. Then do *Design Pad Template* at 3:1 side slopes in Cut and Fill. Your result is shown in 3D.

III. Valley Pond (Tools 6-10)



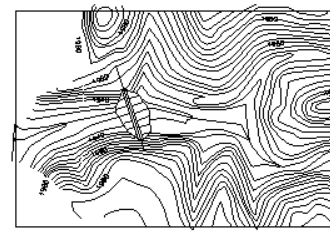
A. Constructing a Valley Dam

We can "carve out" another portion of our base map by first drawing a "Rectang", and then using *Break By Crossing Polyline* under the Edit pulldown menu. We follow this with *Write Block*, and write out a new drawing called Valley1.dwg, seen in the graphic. Unlike *Design Bench Pond*, the *Design Valley Pond* routine requires only a polyline axis line for the center of the dam. The polyline can be a 2-point polyline, or it can have several vertices along its length to create a concave or convex dam structure. The main thing is to "overdraw" the axis polyline - make it ride up on the left and right hillside, well beyond the desired top of dam elevation. This allows the routine to look inward and find the extents of the dam on each hillside, without doing an artificial extension of the polyline. Just "overdo" the length of the axis line and you are in business. Another aspect to concentrate on is the desirability to select enough terrain upstream to enable the program to compute the full waterline extents - the limits of the dammed-up water. Without enough upstream terrain in the initial selection set (which acts like a crossing selection), you will not be able to compute the limits of the water surface and the pond stage-storage information. Our axis polyline runs from approximately 1960 on one side of the valley to 1960 on the other. It crosses the valley at 1931. Let's decide to put the top of dam at 1950 even. We will make the dam 20' wide, with 3:1 downstream and 4:1 upstream slopes. Source of surface model is, as always in this case study, the screen.



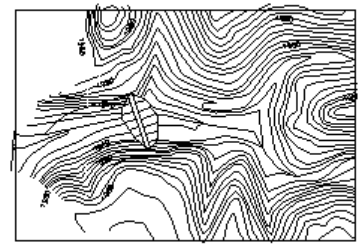
Say N to Cut Pond Interior, and N to Contour. Just follow the prompts in the *Design Valley Pond*

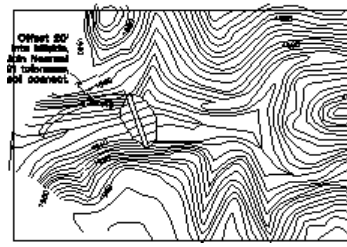
routine to obtain the drawing shown here.



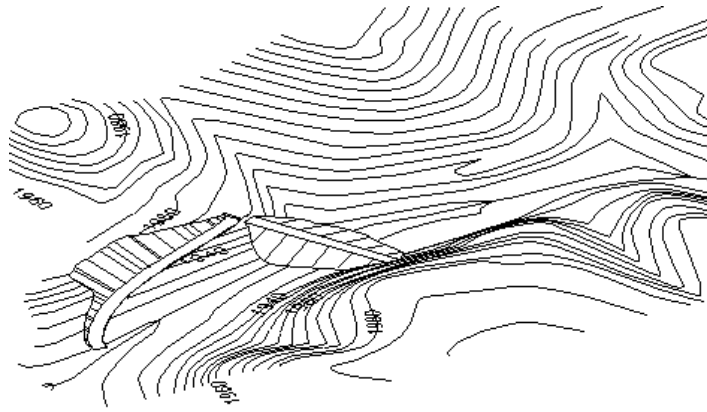
B. 3D Polyline by Slope on Surface

How would you start at the top of dam (elevation 1950) and build a road running downhill at 6% grade? Or, in general, how would you obtain 3D polylines for roads and diversion ditches that follow the terrain at prescribed grades starting at desired points? The answer is *3D Polyline by Slope on Surface* (located in the 3D Data menu). This routine requires that we make a grid file for the terrain. Use the command *Make 3D Grid File* under the Surface pulldown menu, and select a 20x20 cell dimension. Store the file as Dam.grd. Then run the *3D Polyline by Slope on Surface*. Pick a starting point on the north side of the dam. Facing downhill, you will go downhill to the right. After the new 3D polyline is drawn, offset it into the hill with the *Offset 3D Polyline* command, then join the ends with Join Nearest, then use *Design Pad Template* to carve our road into the terrain. Follow that procedure and you obtain the drawings shown here.





In the drawing showing text information at the upper left, we can see that we now have a "pad" for pad template. Because the southern side of the pad follows closed the original ground, it may "cantilever" over into the "air" in a few places based on the resolution of the calculation. It is recommended that the fill ratio used to catch the ground be low, such as 1:1 rather than 2:1, so that short cantilevered sections of the pad, if placed on natural 2:1 terrain, don't "skim" over the ground and create unnecessary fill. For the cut sections, we will use 3:1 to carve the road into the solid hillside. The result can be seen in 3D.



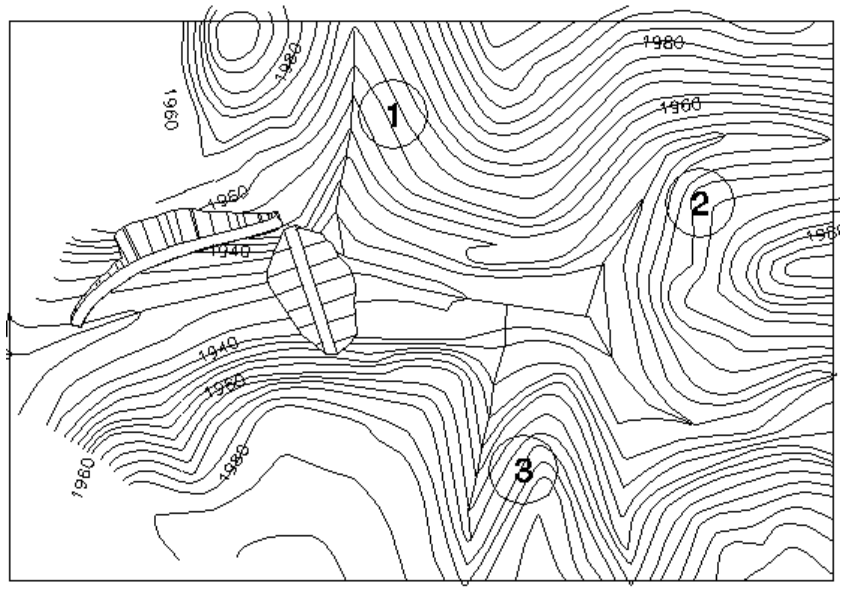
C. 2D to 3D Polyline by Surface Model

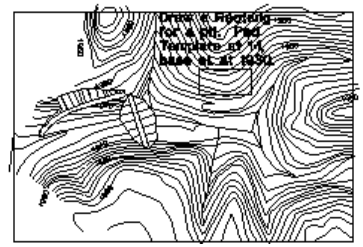
The 3D view above reveals a 3D polyline running up the base of the stream channel in which the pond was built. Such 3D polylines are important in modeling accurate surfaces for pond design, pad templates and volumes in general. For example, if you were to triangulate and contour the valley at 1' interval (currently the contours are at 4' interval), you would obtain poor valley contours which "square off" in the valley - if you did not select the 3D Polyline "break line". Thus, an important strategy - better yet, policy - is to dress up raw contour maps with valley and ridgeline 3D polylines that act as break lines, and restore the true character of the terrain. The

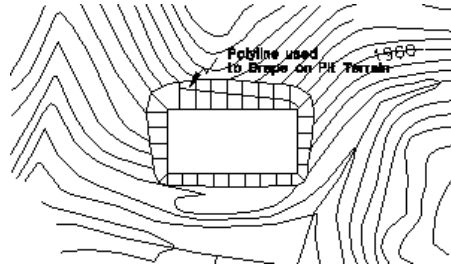
best way to make these 3D polylines is to draw 2D polylines in drains and ridges (see the three circled examples) and "drape" them on the terrain. This is done by the *2D to 3D Polyline by Surface Model* command, found under the 3D Data pulldown menu.

D. Creative Uses of 2D to 3D Polyline by Surface Model

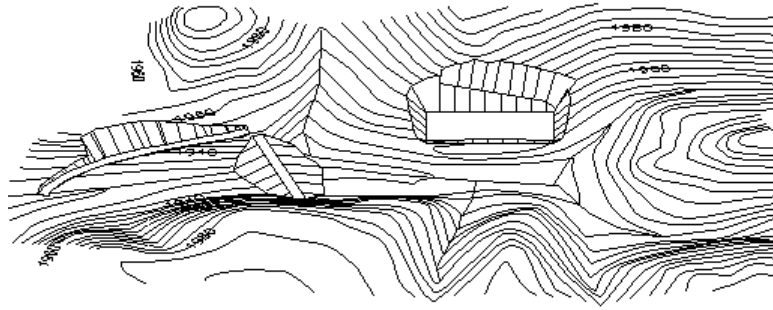
More than a command to "dress up" contour maps for greater modeling accuracy, the *2D to 3D Polyline by Surface Model* command (sometimes called the "drape" command) has unexpected uses. In the example, a strata angling along a pit face creates instability in the upper part of the pit. The goal is to "lay back" the pit at 2:1 above the strata demarcation line, and retain the 1:1 slope below that line (which is drawn as a 2D pline at the outset).





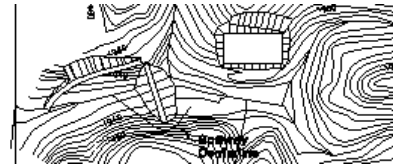


After the 3D Polyline is "draped" on the surface, you should use *Change > Elevations,* under Edit, to drop the entire 3D Polyline just a little, such as -0.2. This will ensure it is fully in Cut. Then the *Design Pad Template* command can be used to perform a one-sided offset at 2:1 in Cut, resulting in the drawing, shown here in 3D view.

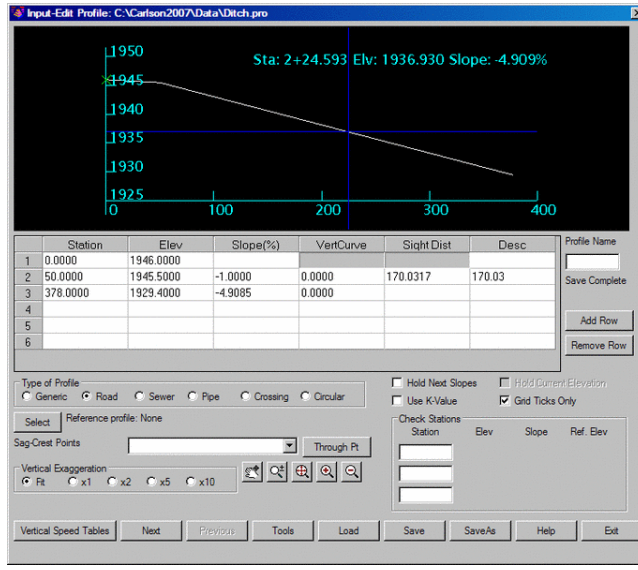


E. Build a Diversion Ditch around the Dam Using Input-Edit Profile and Profile to 3D Polyline

With Osnaps turned off, draw a simple 2D polyline ("PL" command or Carlson's "2DP") that starts on the water side of the valley dam, and curves around the hill to the south and into the drainage below the dam, as shown in the graphic. The syntax for this using the PL command is: pick first point, pick second point to get a tangent (straight section) going, then type A for arc, arc it around the dam, then do L for line and a second L for length, and pick a point that comes off tangent from the arc and ends in the stream bed below the dam. Then Enter to exit the PL command.

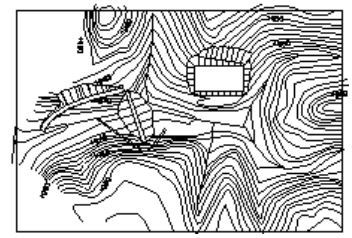


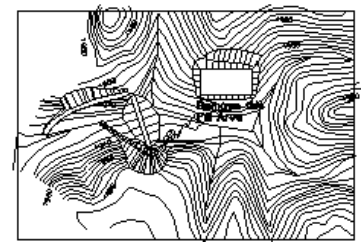
Now we are going to make this 2D polyline a 3D polyline with a prescribed profile. To prepare for this, we do *Polyline Info*, under the Inquiry pulldown menu, and write down the length of the polyline (this will become the length of the profile we enter). This one here is 377.6 feet, which we will round up to 378. We then use *List Elevation*, under the Inquiry pulldown menu, and pick on the 3D polyline as close as we can to the point where our 2D polyline makes contact. That elevation is reported as 1929.4 (along with all vertices elevations). We determine ahead of time that we want the first 50 feet of the diversion ditch to be a 1% downhill slope, starting at elevation 1946 (allowing 4 feet of freeboard to the top of the dam at 1950). We are ready for *Input-Edit Profile File*, in the Profile menu. We fill out the profile dialog as shown in the graphic.



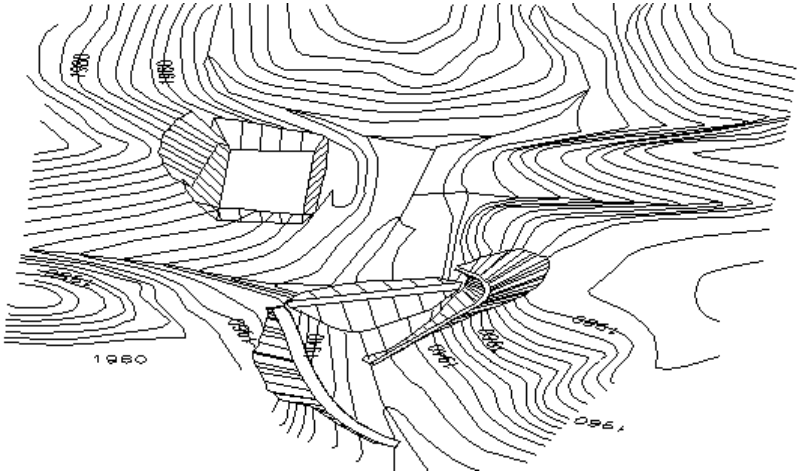
The order of entry might be 0 and 1946 on the first line, 378 and 1929.4 on the third line, and

50 and slope% of _1 on the second line, completing the profile. Save it, and Quit from the dialog. The one remaining step to get a 3D polyline is to select the command *Profile to 3D Polyline*, under the Profile pulldown menu. Pick the ditch centerline and apply the newly saved profile to it. Erase the old centerline and you obtain a "yellow" colored 3D polyline centerline. Use the command *Offset 3D Polyline* to offset the ditch into the hill 8 feet for an 8' base (or offset 4' either way and erase the original centerline). In either case, you have two parallel 3D polylines. Now, do Join Nearest, tolerate 9' of separation and Directly Connect Endpoints within *Join Nearest*. (Note how *3D Polyline*, *Offset 3D Polyline* and *Join Nearest* become a familiar sequence in doing pad template work!). Now do *Design Pad Template* at a cut slope of 1.5 to 1.



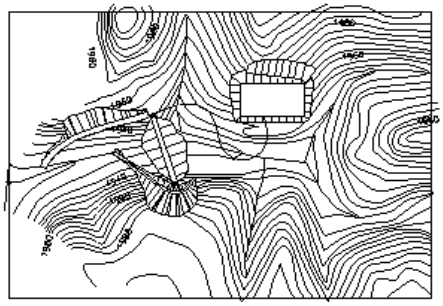


If it is apparent that the diversion ditch was initially drawn too far into the pond area and created fill, as seen in the graphic, then there is the option to re-design or simply to trim off the fill portion. This likewise applies to the portion of the diversion ditch at its terminus downstream. Note that gaps in contours that need to be re-closed can be very quickly fixed with *Join Nearest*. With the trimming completed, the final design appears in 3D.



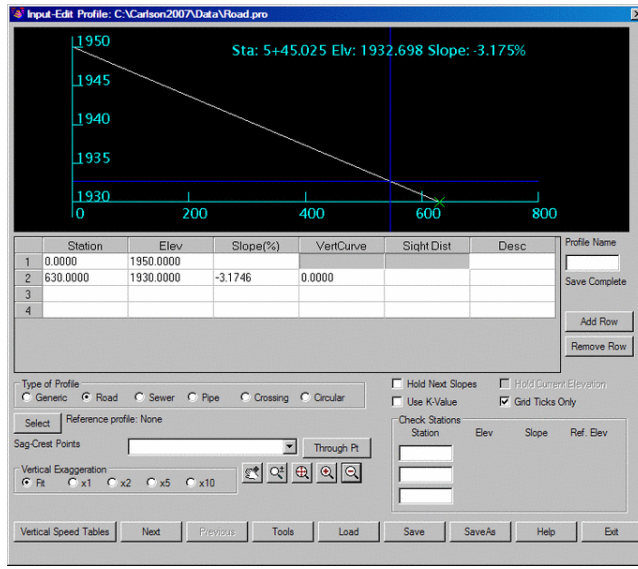
F. Build a Curving Road from Top of Dam to Base of Pit using Input-Edit Profile and Profileto 3D Polylir

Looking at the 3D view in the graphic, lets extend the road from the top of dam into the base of the pit, following a uniform grade and entering the pit at right angles on the south side (or right-side, as seen in the graphic). This "word problem" is nothing more than another iteration of *Input-Edit Profile File* and *Profile to 3D Polyline*. The first challenge is to draw the 2D polyline using the PL command. We've already learned how to do this and use the second L approach to come off tangent from an arc. We end up with a centerline that might look like the one in the graphic.

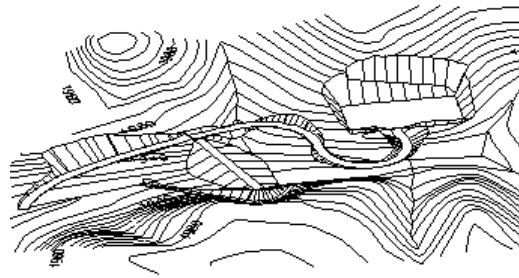


Just as before, find the length of the polyline using *Polyline Info,* under Inquiry. We know the

profile: it runs from 1950 (the top of dam) down to 1930 in the base of pit. So we go straight to *Input-Edit Profile File*, perhaps name it Road (Road.pro) and put in a simple two-entry profile as shown in the dialog box display here.



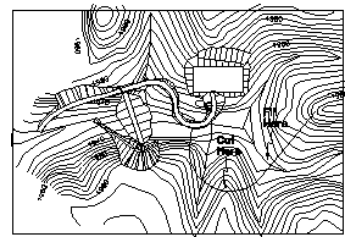
The slope of the road at -3.17 percent is very acceptable for any type of vehicle. So now we choose *Profile to 3D Polyline,* and apply Road.pro to the road centerline. This time we will offset the new 3D polyline 10 feet either side using 3D Polyline Offset, and erase the original middle centerline (or render it harmless for terrain modeling by the command *3D Entity to 2D* under Edit). This raises an important point: when we select entities from the screen using *Design Pad Template*, *Design Valley Pond* and *Design Bench Pond*, the pad or pond polyline itself is filtered out of the selection set, and it is not used for modeling the original surface. If we left intact a 3D polyline centerline that was not part of our pad, it would skew the surface model badly. Thus, if we offset left and right for the outside of the road, the middle of the road must go, must be erased, unless we chose the "grid file" option for the original surface. After offsetting 10' either side and erasing the center 3D polyline, we Join Nearest at a 21' tolerance. Then we do *Design Pad Template* at standard 2:1 slopes. Here is the final 3D view. (You might use *Design Pad Template* to divert the ditch and not flood the pit!).



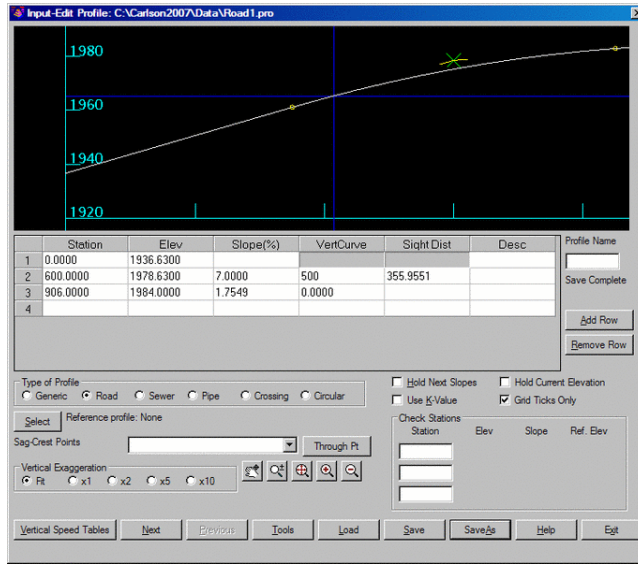
IV. Pad Template in Combination with Design Template for Roads, Ditches, and Levees (Tools 6-10)

A. Roads with Ditches and Berms

The limitation of Offset 3D Polyline within Pad Template is that roads cannot easily be given dynamic characteristics: They won't automatically carve in ditches in cut, or build a berm in fill where fill exceeds a certain threshold, for example. Since these "intelligent" features exist within the *Design Template* routine in the Roads menu of the Civil Design module, all we need to do is invoke the "template" option within the Pad Template. Pad Template will then go out and get a Design Template and apply it to the one-sided or closed pad perimeter. To illustrate this, let's first make a centerline that will have cut and fill. Consider the centerline drawn in the graphic.



If we go a uniform grade from the existing road, upward to the ending elevation (which might represent a mining bench), we are "bound" to get cut as we cross the lower point and fill as we cross the second drain. To "guarantee" fill, we will go uphill early and lessen the last portion of the grade, using a vertical curve length of 500 between profile grades. This is another exercise of Polyline Info (for length), verifying start and end grades, and Input-Edit Profile (as shown in the dialog).



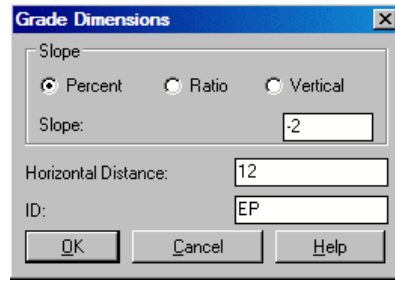
With the profile input (named road1.pro), we can select *Profile to 3D Polyline* and turn yet another 2D polyline into a 3D polyline. The difference now is that we will not offset the 3D polyline to create a closed, looping "pad". We will instead use a template made in *Design Template*, and apply it to the 3D polyline.

B. Entering a Template in Design Template

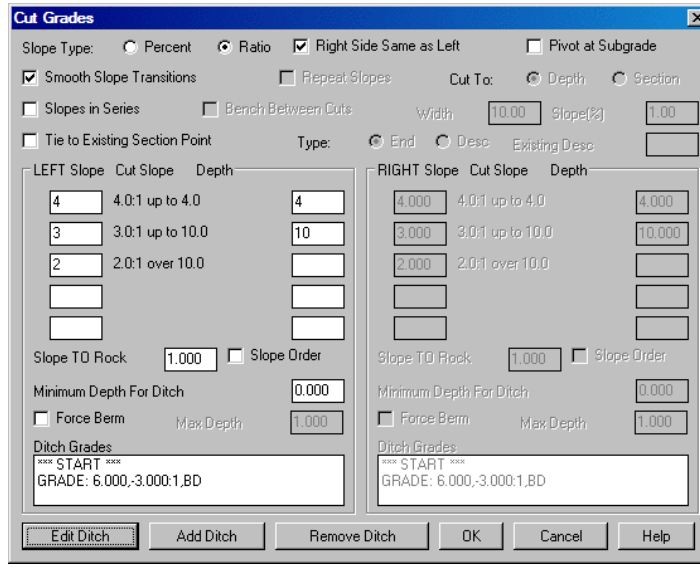
Design Template, located under the Roads menu in the Civil Design module, is icon driven. See this horizontal strip of icon options.

Shown here is a selection of dialogs that illustrate our entry of a 24' wide road (12' either side) at 2% slope, no shoulder, no subgrade, a 3:1 slope for 6' to the base of ditch, a conditional cut upslope, a 3:1 slope in fill, but a 2:1 berm in fill, rising 4 feet, used when fill exceeds 5 feet. To begin with, this small dialog appears when the Grades button, within the Design Template dialog

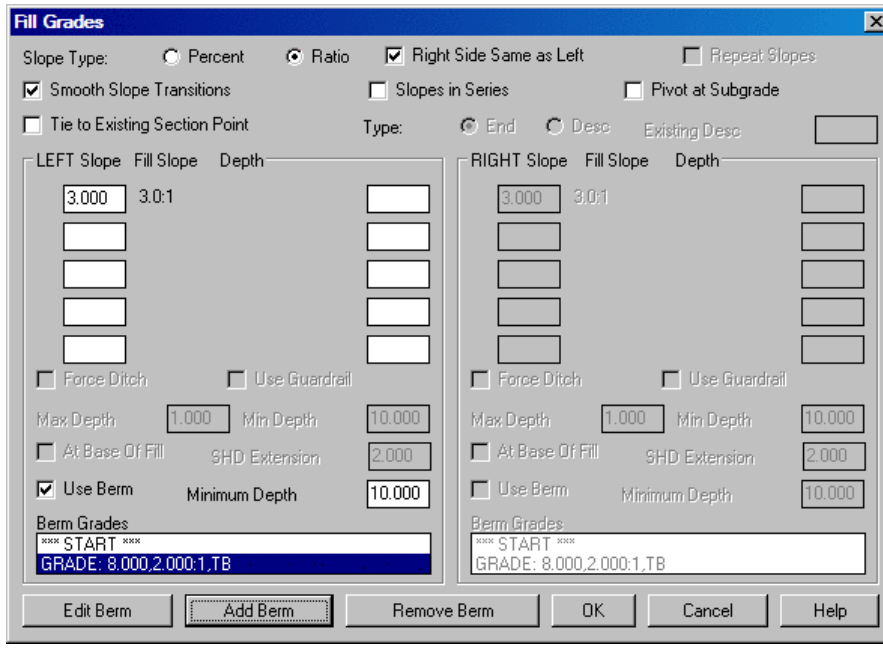
box, is clicked.



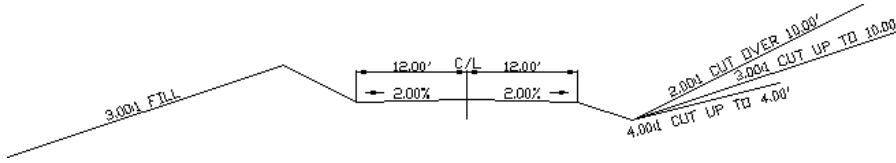
Note that when you are putting in a ditch, you need to click "Start" at the lower-left of the Cut Grades dialog. The conditional cut upslopes mean 4:1 up to 4 feet of fill, 3:1 between 4 and 10 feet of fill and 2:1 above 10 feet of fill.



The Fill Grade dialog looks similar, with two entries for berms (Add Berm is selected twice), one for up slope at 2:1 for 8 feet (which translates to 4 feet vertically) and a second for downslope of 2:1 for 8 feet for the back of berm.

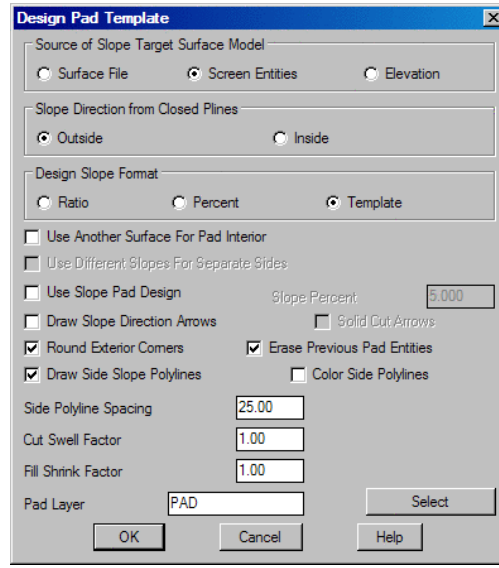


The "typical section" can be drawn using the command *Draw Typical Template* under Roads. This will help you verify the quality of your template. Our template is shown here.

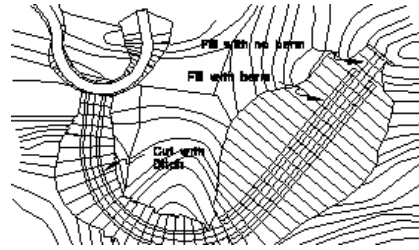


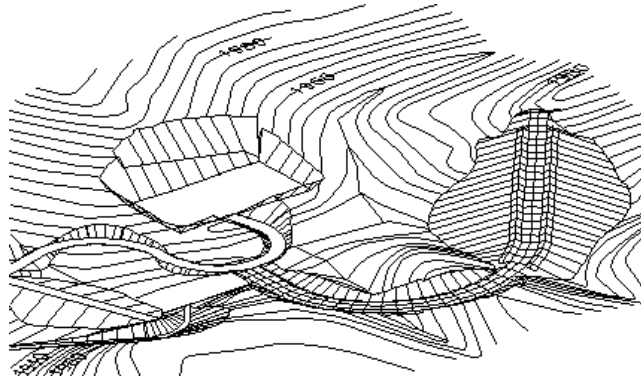
C. Design Pad Template

Now let's use the *Design Pad Template* routine, found in the Grading menu. The dialog box for *Design Pad Template* is filled out as shown.



For the first time, we have selected the "template" option under Design Slope Format. The program will prompt for a cross section interval. Let's use 20. Finally, here is how the road appears in 3D using the command View (menu) > *Viewpoint 3D*.





This completes the Lesson 8 tutorial: A Dozen Tools for Surface Design.

Lesson 9: Calculate Volumes By Five Methods

For this tutorial, we'll be using a sample stockpile drawing and calculating its volume using five distinct techniques.

1. **Two Surface Volumes**: Calculates volumes between two grid files

2. **Stockpile Volumes**: Creates grid surfaces from perimeter polyline and surface entities and calculates volumes in one command

3. **Volumes By Layers**: Creates grid surfaces from existing and design layers and calculates volumes in one command

4. **Volumes By Triangulation**: Calculates volumes between two triangulation files

5. **Calculate Sections Volumes**: Calculates volumes between two section files using volumes by average end areas

Each of these routines has it's own advantages. You can choose the routine that best suits your data or run multiple methods as a check of the volumes. The volume reports for each of these routines will vary slightly due to using different types of surface models that have different resolutions. These volume differences should be less than 2%. If there is a greater difference, try increasing the resolution of the surface models. For grids, make the grid cell size smaller and for sections, make the station interval smaller. If there is still a significant difference, then the cause

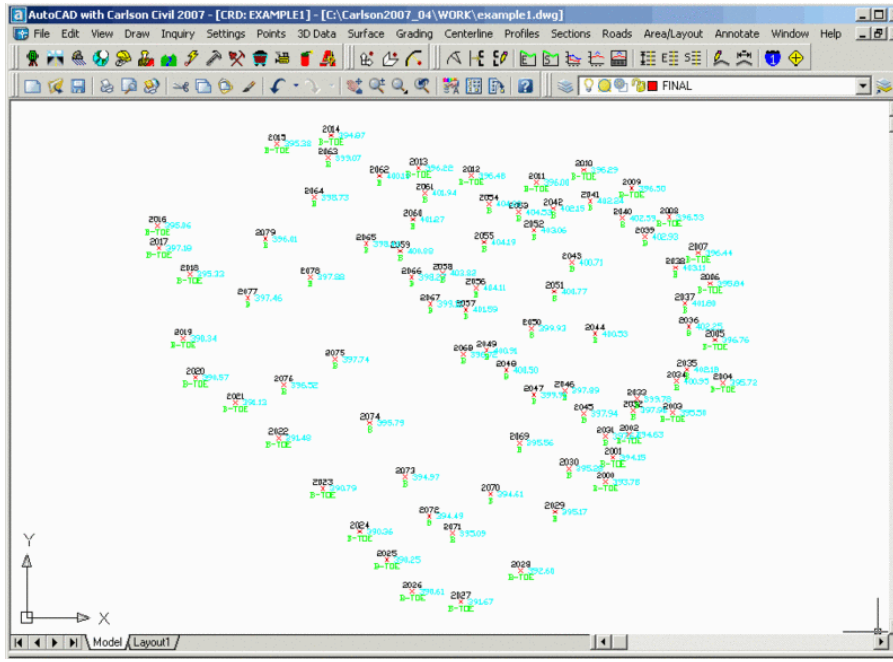
should be investigated by checking the source data and the program procedures.

Common Steps

The following are common preparation steps for all five volume methods.

Step 1 - Open Drawing:

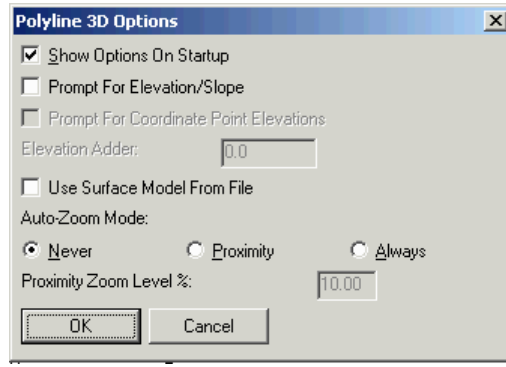
From the File menu, choose Open and select EXAMPLE1.dwg from the Carlson Work folder (ie. C:\Carlson2007\WORK\EXAMPLE1.dwg).


AutoCAD with Carlson Civil 2007 - [CRD: EXAMPLE1] - [C:\Carlson2007_04\WORK\example1.dwg]
File Edit View Draw Inquiry Settings Points 3D Data Surface Grading Centerline Profiles Sections Roads Area/Layout Annotate Window Help
FINAL
Model Layout1

Step 2 - Draw Perimeter:

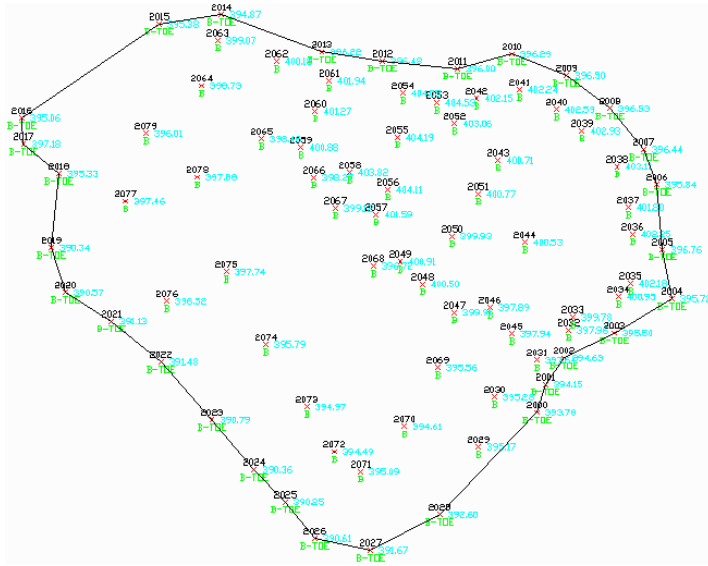
We begin by drawing a perimeter polyline using the outermost points of the stockpile. The perimeter polyline limits the volume calculation to the area within the polyline. In this example, the perimeter polyline consists of points 2000 - 2028 with description B-TOE. To pick these

points, set your osnap to Node using the Aperature-Object Snap under the Settings pulldown menu and turn off all the other osnap methods. Then run *Draw 3DPoly Perimeter*, found in the Grading menu. The *Draw 3DPoly Perimeter* command is the same as 3D Polyline in the Draw menu, except that it will automatically put the polyline in a layer called PERIMETER and close the polyline. For the Polyline 3D Options dialog, choose the settings as shown.



Then pick all the perimeter points one at a time. At the command line, the program will prompt as follows:
[Continue/Extend/Follow/Options/<Pick point or point numbers>]: *pick a B-TOE point*
[Arc/Close/Distance/Follow/Undo/<Pick point or point numbers>]: *pick the next point*
...
[Arc/Close/Distance/Follow/Undo/<Pick point or point numbers>]: *press Enter to end*

After you draw your perimeter polyline, simply return your osnap to none.



Step 2 - Faster Draw Perimeter, Revisited:

There are other methods for drawing the perimeter polylines that are much faster than picking each point.

The *Draw 3DPoly Perimeter* command can draw by point numbers from the coordinate file. If you have the coordinate file for the points, then you can go directly to draw and use the point numbers. In this example, we have only the drawing and no coordinate file. Still we can easily create a coordinate file from the points in the drawing. First run Points>Set Coordinate File, and in the file selection dialog, choose the New tab and enter example1 for the file name. Next run Points > Coordinate File Utilities and pick Update CRD File From Drawing. Go with all the defaults for this function and when prompted to select objects, enter All. Now the coordinate file has all the points from the drawing. In this example, the perimeter points are sequencial. So at the Draw 3D Poly Perimeter command prompt for points, you can enter the point range of 2000-2028 and it's done.
[Continue/Extend/Follow/Options/<Pick point or point numbers>]: *2000-2028*
[Arc/Close/Distance/Follow/Undo/<Pick point or point numbers>]: *press Enter to end*

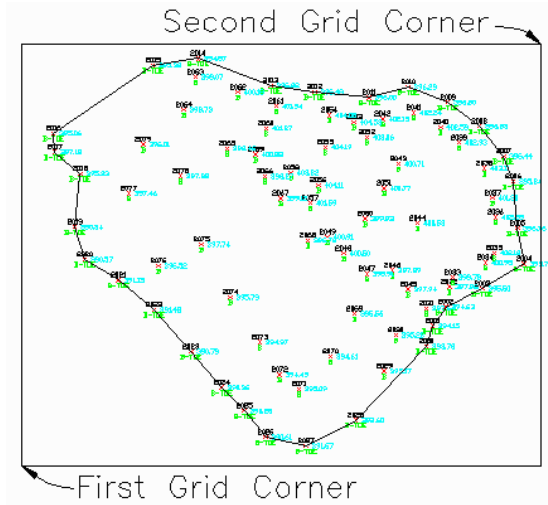
Another even more automated way to draw the perimeter is to use Field-To-Finish from the Survey menu to draw the points and the perimeter at the same time. In Field-To-Finish, you

can control how to draw the points based on the point description. And you can create linework by point description. For this case, the Field-To-Finish code for B-TOE could be set as a 3D Polyline.

Volume Method 1 - Two Surface Volumes

Step 1 - Make Base Grid Surface:

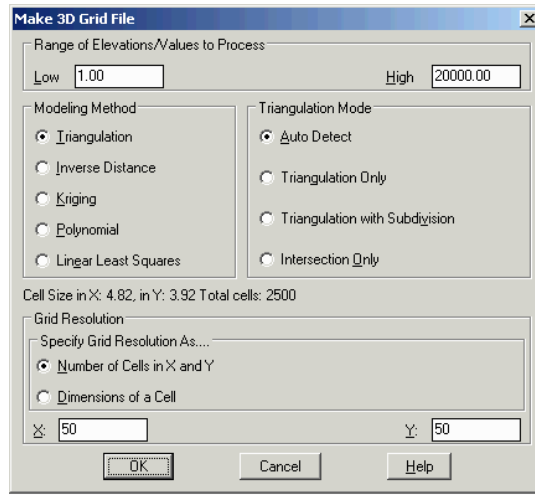
Before running *Two Surface Volumes*, we must create the two grid files by using the *Make 3D Grid File*, located under the Surface menu. The first grid file will be for the base of the stockpile. At the file selection Grid File To Create dialog, enter a name of BASE and click Save. Next, the program prompts at the command line for the grid location. Use the option to pick the grid position from the screen and create the rectangular area for the grid surface that completely encloses the stockpile.
Use position from another file or pick grid position [<Pick>/File]? *P for pick*
Pick Lower Left grid corner: *pick to the lower left of the stockpile*
Pick Upper Right grid corner: *pick to the upper right of the stockpile*



Next, there is a dialog to set the the gridding parameters. The Low and High elevations are used to filter out elevations outside the range. By default the Low elevation is set to 1 which filters out

zero and negative elevations. For the Modeling Method, use the default Triangulation method for surface models. The other method are primarily for strata geologic models. For Triangulation mode, the Triangulation Only method triangulates all the data points. The Triangulation with Subdivision does the Triangulate step followed by subdividing the large triangles to make a smoother surface. The Intersection Only method interpolates the grid corners from the intersections of the grid lines with the surface linework which applies to making a grid from all contour polylines. The Auto Detect method looks at the source data and chooses Intersection if all the data is linework or uses Triangulation otherwise.

The grid resolution sets the size of the grid cells either by entering the actual size or by the number of cells. Generally, you should use a grid size that is small enough to pick up the changes in the surface. At the same time, the total number of cells should be less than a million depending on your computer memory. In this example, we have 50x50 cells which results in a cell size of 4.82 in X (Easting) and 3.92 in Y((Northing), and this is enough resolution for the data.



Next, the program prompts at the command line to select the entities to use for the model. For the base surface, select only the 3D perimeter polyline.

Select points, lines, polylines and faces to grid from.
Select objects: *pick the 3D perimeter polyline*

Select objects: 1 found
Select objects: *press Enter*

Step 2 - Make Final Grid Surface:

Next, let's create the top of the stockpile surface by repeating *Make 3D Grid File* used in the last step. Choose *Make 3D Grid File* from the menu and enter a grid file name of PILE in the file selection dialog. At the prompt for grid position, use the File method and select base.grd as the reference grid position. This file method uses the grid position and resolution from the selected reference grid. For Two Surface Volumes, the two grids to compare should have matching grid positions and resolution.

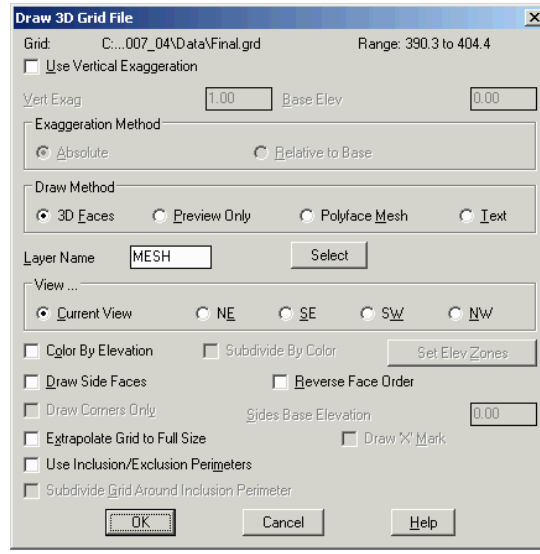
Then there are a series of command line prompts for the elevation range and modeling method. Press Enter for each of these prompts to go with the defaults. Then for the selection of objects to process, enter All to use the stockpile pereimeter plus all the points.

Use position from another file or pick grid position [<Pick>/File]? *F for File*
Grid File To Get Position From *Choose base.grd*
Range of Elevations to Process.
Low elevation <1.00>: *press Enter*
High elevation <20000.00>: *press Enter*
Choose modeling method [<Triangulation>/Inverse dist/Kriging/Polynomial/LeastSq]? *press Enter*
Triangulation mode [<Auto>/Triangulate/Subdivide/Intersect/Both]? *press Enter*
Select points, lines, polylines and faces to grid from.
Select objects: *All*
Select objects: *press Enter*

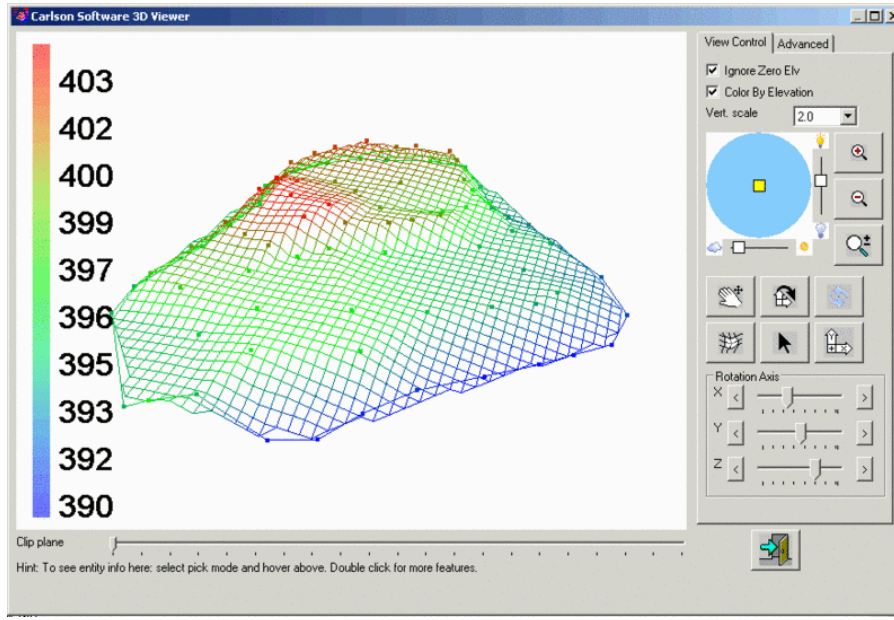
Step 3 - Check Surfaces:

This step is optional to verify that the surfaces are good by checking for bad elevation data points and that the surfaces follow the data points. There are several routines that can be used to check the surfaces, including Draw 3D Grid File, Surface Inspector and Contour From Grid File. For this example, we will use Draw 3D Grid File and Surface Inspector.

In the Surface menu, choose the *Draw 3D Grid File* command. At the Select Grid File dialog, choose FINAL.grd. In the options dialog, go with the settings shown here and pick OK.

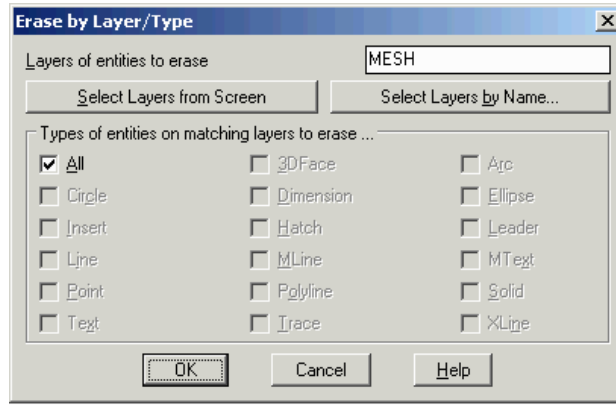


With the grid drawn as 3D Faces, run the 3D Viewer Window command in the View menu. At the command line, it will prompt to select the objects to view. Enter All and press Enter.
Select all entities for the scene.
Select objects: *All*
Select objects: *press Enter*



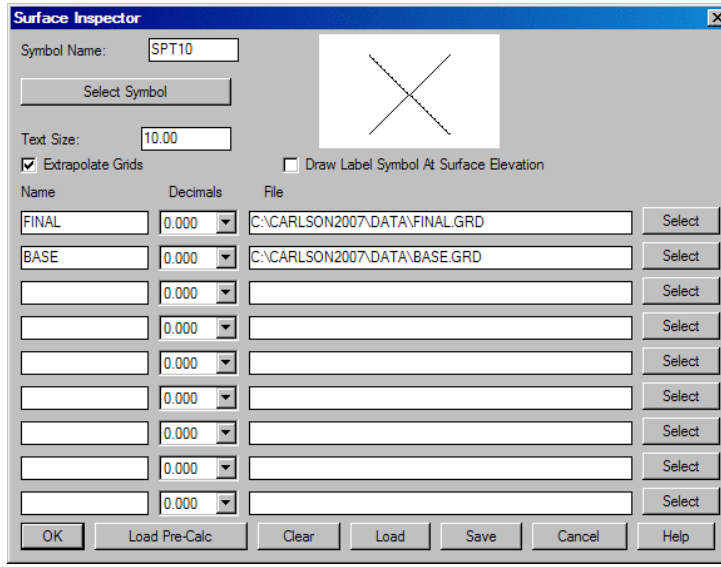
In the 3D Viewer dialog, move the pointer near the center of the graphic and the cursor will change to a X/Y symbol which is the X/Y axis rotation mode. Click down the left mouse button and drag down to rotate the pile to a good viewing angle. Then move the pointer near the edge of the graphic and the cursor will change to a Z symbol which is the Z axis rotation mode. Click down the left mouse button and drag around to rotate the pile. You can also set the Vertical Scale to 2.0 and choose the Color By Elevation toggle for better viewing of the elevation difference.

The surface looks right in the 3D Viewer. Close the 3D Viewer by choosing the Exit Door button. We don't need the 3D Faces anymore. Let's delete them by running *Erase By Layer* in the Edit menu. Choose the Select Layers From Screen and pick any 3D Face. Then pick the OK button.

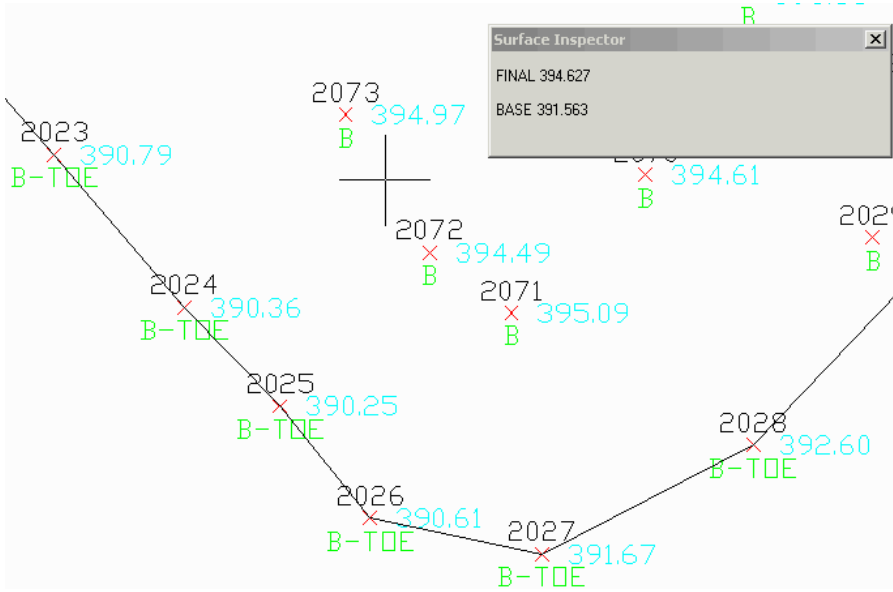


The Draw 3D Face check could also be run on the base.grd surface using the same procedure as above, but we're going to skip that in this tutorial to save space.

Now, let's check using Surface Inspector. First, use Zoom Window under View to zoom onto the bottom of the pile so that we can easily read the point elevation labels. Then run Surface Inspector from the Surface menu. In the dialog, set base.grd and final.grd as the two surfaces to inspect and then pick OK.



Now, move the pointer around the pile and the program reports the elevation of the two surfaces in real-time. Check that the grid elevations match the point elevations reasonable well. Remember that the base elevations are using only the B-TOE points. The elevations won't match exactly with grid surfaces because the grid model is at the resolution of the grid cells. When finished checking, press Enter. Then run (Zoom) Extents, under View, to return to the full view.

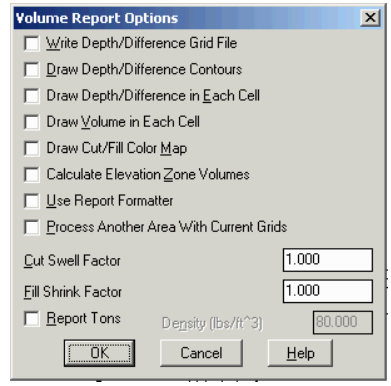


Step 4 - Two Surface Volumes:

Now that you have your base file and final grid files, to calculate volumes use the *Two Surface Volumes* command in the Grading menu, under the Volumes By Grid Surface flyout. When you run this command, the inclusion perimeter is once again the perimeter polyline. Then there is a prompt for an exclusion perimeter which is an area to exclude from the volume calculations. In this example, press Enter for no exclusion. Next the routine prompts for the Base and Final grid files. Choose base.grd and final.grd. The Volume Report Options menu is next which has

output options such as cut/fill labels, cut/fill color map and cut/fill contours including drawing the daylight line. Click OK and a Volume Report is then produced.

Select the Inclusion perimeter polylines or ENTER for none.
Select objects: *Select the perimeter polyline*
Select objects: *press Enter*
Select the Exclusion perimeter polyline or ENTER for none.
Select objects: *press Enter*
Select Base Grid File *Choose base.grd*
Select Final Grid File *Choose final.grd*



Volume Report
Comparing GRiD file: C:/CARLSON2007/DATA/BASE.GRD
and GRiD file: C:/CARLSON2007/DATA/FINAL.GRD
Grid corner locations: 8109.69,3986.49 to 8350.70,4182.31
Grid resolution X: 50, Y: 50 Grid cell size X: 4.82, Y: 3.92
Area in Cut : 201.6 S.F., 0.00 Acres
Area in Fill: 24,983.5 S.F., 0.57 Acres
Total inclusion area: 25,185.1 S.F., 0.58 Acres
Cut to Fill ratio: 0.00
Average Cut Depth: 0.18 Average Fill Depth: 3.52
Max Cut Depth: 0.67 Max Fill Depth: 9.00
Cut (C.Y.) / Area (acres): 2.33
Fill (C.Y.) / Area (acres): 5639.92
Cut volume: 36.3 C.F., 1.35 C.Y.

Fill volume: 88,042.5 C.F., 3,260.83 C.Y.

Volume Method 2 - Calculate Stockpile Volume

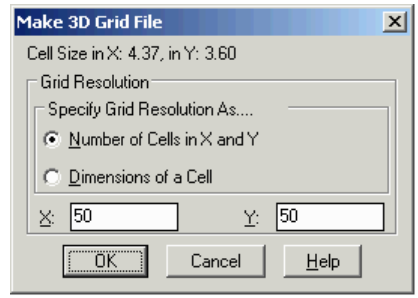
Step 1 - Calculate Stockpile Volume:

The Calculate Stockpile Volume routine is based on grid surfaces like Two Surface Volumes. The difference with this routine is that it builds the grid surfaces within the routine to save the steps of running Make 3D Grid file. The fewer steps makes this routine faster and easier but it doesn't have options for checking surfaces. Instead the input data entities should be checked before running this routine. Also, Calculate Stockpile Volume only applies to volumes calculations when the volume is all fill.

Choose Calculate Stockpile Volume from the Grading menu. The routine starts with prompts at the command line.

Material density lbs/ftˆ3 (Enter for none): *press Enter.* This density option applies when you're measuring a stockpile of a material with a known density and you want to report the material tons for the stockpile.
Ignore zero elevations [<Yes>/No]? *press Enter.* Use the ignore zero option to filter out zero elevation entities.
Select stockpile entities and perimeter.
Select objects: *All*
Select objects: *press Enter*
The program looks for a closed 3D polyline on the PERIMETER layer to use as the inclusion perimeter and the base surface model. If this polyline is not found, then the program will prompt to select the perimeter polyline. All the selected entities including the perimeter are used to model the second surface of the stockpile top.

Specify the grid resolution as shown in the dialog. The same rules for grid resolution apply as described in the Two Surface Volumes step.



Volume Report
Lower left grid corner : 8124.32,3995.70
Upper right grid corner: 8342.98,4175.90
X grid resolution: 50, Y grid resolution: 50
X grid cell size : 4.37, Y grid cell size: 3.60
Stockpile volume : 88,071.8 C.F., 3,261.92 C.Y.

Volume Method 3 - Volumes By Layers

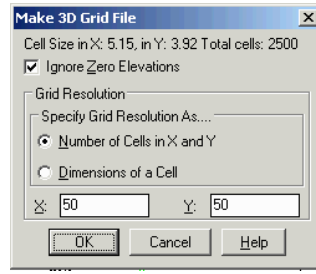
Step 1 - Volumes By Layers:

Like the two previous volume methods, Volumes By Layers is based on grid surfaces. Similar to Calculate Stockpile Volume, this routine builds the grid surfaces within the routine to save the steps of running Make 3D Grid file. The difference between this routine and Calculate Stockpile Volume is that Volumes By Layers uses entities on the specified layers for existing and design to build the surfaces and it will calculate both cut and fill volumes.

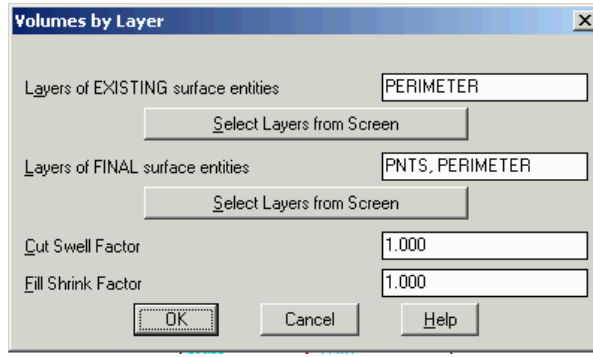
Choose Volumes By Layers from the Volumes By Grid Surface flyout of the Grading menu. The routine starts with prompts to set the grid area to model. In the same way as the Make 3D Grid File step of Two Surface Volumes, pick two corner points that make a rectangle to enclose the stockpile area.

Pick Lower Left grid corner: *pick to the lower left of the stockpile*
Pick Upper Right grid corner: *pick to the upper right of the stockpile*

Next, there is a dialog to set the grid resolution. Again, the same rules for grid resolution apply as described in the Two Surface Volumes step.



In the next dialog, set the layer names for the entities to use for the Existing (Base) and the Final (Design) surfaces. For this example, pick the Select Layers From Screen button under Existing and then select the perimeter polyline. Then pick the Select Layers button under Final and select both the perimeter polyline and the points.



After specifying the layer names, click OK in the dialog. Then the program prompts to select the surface entities to model. For this example, type All and press Enter to process all the entities. The program will sort the entities for modeling of the existing and design surfaces by the layer names. Next, you specify the inclusion and exclusion perimeters. For the stockpile, pick the perimeter polyline for the inclusion and press Enter for none at the exclusion prompt. The same

Volume Report Options dialog then offers the same output options as Two Surface Volumes. After this dialog, the report is displayed.

Select surface entities on corresponding layers.
Select objects: *All*
Select objects: *press Enter*
Select the Inclusion perimeter polylines or ENTER for none.
Select objects: *Select the perimeter polyline*
Select objects: *press Enter*
Select the Exclusion perimeter polyline or ENTER for none.
Select objects: *press Enter*
Volume Report Options dialog *Pick OK*

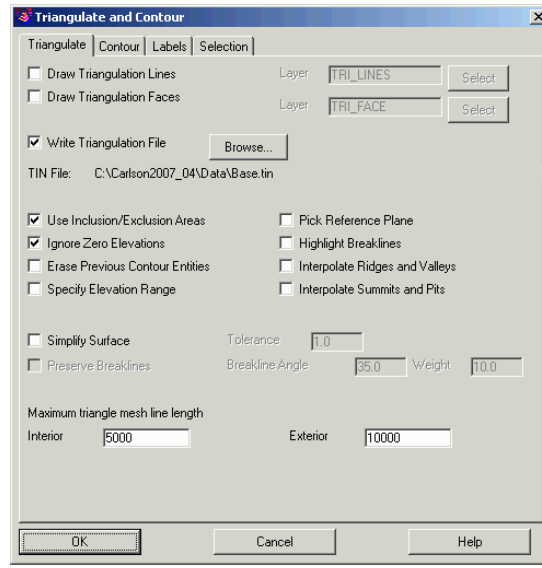
Volume Report
Comparing GRiD file: c:/Carlson2007/USER/grid1.grd
and GRiD file: c:/Carlson2007/USER/grid2.grd
Grid corner locations: 8101.30,3989.34 to 8359.04,4185.40
Grid resolution X: 50, Y: 50 Grid cell size X: 5.15, Y: 3.92
Area in Cut : 191.4 S.F., 0.00 Acres
Area in Fill: 24,992.5 S.F., 0.57 Acres
Total inclusion area: 25,183.9 S.F., 0.58 Acres
Cut to Fill ratio: 0.00
Average Cut Depth: 0.18 Average Fill Depth: 3.52
Max Cut Depth: 0.65 Max Fill Depth: 9.03
Cut (C.Y.) / Area (acres): 2.24
Fill (C.Y.) / Area (acres): 5637.55
Cut volume: 35.0 C.F., 1.30 C.Y.
Fill volume: 88,001.4 C.F., 3,259.31 C.Y.

Volume Method 4 - Volumes By Triangulation

Step 1 - Triangulate & Contour for Base:

Before running Volumes By Triangulation, we need two triangulation surface files to compare. From the Surface menu, choose Triangulate & Contour which brings up the Triangulate & Contour dialog. Under the Contour tab, turn off Draw Contours. Actually, drawing the contours at this step can be a good visual check that the surface is right but we're going to skip it this time.

Under the Triangulate tab, turn on Write Triangulation File, Use Inclusion Perimeter and Ignore Zero Elevations. Then pick the Browse button and set the file name as base.tin. When the dialog is set as shown, pick OK.



Next, the program prompts for the inclusion and exclusion perimeters. Choose the perimeter polyline for inclusion and nothing for exclusion. Then you select the entities to triangulate. For the base surface, pick only the perimeter polyline and then press Enter.

Select the Inclusion perimeter polylines or ENTER for none.
Select objects: *pick the perimeter polyline*
Select objects: *press Enter*
Select the Exclusion perimeter polylines or ENTER for none.
Select objects: *press Enter*
Select the points and breaklines to Triangulate.
Select objects: *pick the perimeter polyline*
Select objects: *press Enter*
Reading points... 29
Inserted 29 points.

Inserted 29 breakline segments
Writing Triangulation File: c:\Carlson2007\DATA\base.tin

Step 2 - Triangulate & Contour for Stockpile:

To create the second surface, repeat step 1 with a few changes. In the Triangulate & Contour tab, choose Browse, and set the file name to final.tin. Then pick OK.

For the inclusion and exclusion perimeters, again choose the perimeter polyline for inclusion and nothing for exclusion.. At the select objects prompt, enter All and press Enter to use all the points and the perimeter to make the stockpile surface.

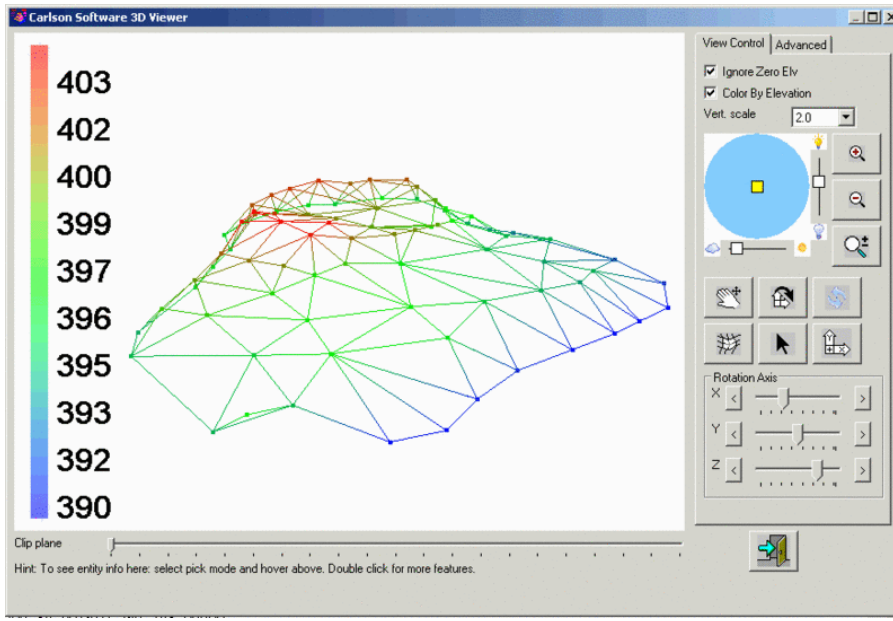
Select the Inclusion perimeter polylines or ENTER for none.
Select objects: *pick the perimeter polyline*
Select objects:*press Enter*
Select the Exclusion perimeter polylines or ENTER for none.
Select objects: *press Enter*
Select the points and breaklines to Triangulate.
Select objects: *All*
Select objects: *press Enter*
Reading points... 80
Ignored 2 points with zero elevation.
Inserted 80 points.
Inserted 29 breakline segments
Writing Triangulation File: c:\Carlson2007\DATA\final.tin

Step 3 - Check Surfaces:

Similar to the Check Surfaces step under Two Surface Volumes, this is an optional step to check that the surfaces are correct. Again, there are several routines to check including drawing the surfaces, contouring and Surface Inspector. Let's use the draw check. Under Surface menu, choose Draw Triangular Mesh and choose final.tin. Go with the defaults for layer name and type of draw entities of 3D Faces.
Layer name <TMESH>: *press Enter*
Draw TIN as 3D Lines or 3DFaces [Lines/<3DFaces>]? *press Enter*

Next, run the *3D Viewer Window* command from the View menu. Just as in the Check

Surfaces under *Two Surface Volumes*, type All and press Enter at the select objects prompt to view everything. Then in the viewer window, use the mouse click-and-drag methods to rotate the stockpile into view. Also, set the Vertical Scale to 2.0 and turn on Color By Elevations.



Close the 3D Viewer by choosing the Exit Door button. We don't need to keep the 3D Faces. Again, let's use Erase By Layer in the Edit menu to delete them. Choose the Select Layers From Screen and pick any 3D Face. Then pick the OK button.

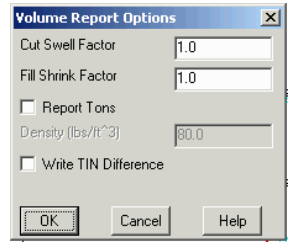
Step 4 - Volumes By Triangulation:

Now that we have our two triangulation files, we can use *Volumes By Triangulation* which does TIN to TIN primodal volumes. Of all the volume methods, this one is the most accurate since all the source data points are used in the volume model. *Volumes By Triangulation* is well suited for this example. Still, the grid surface method of *Two Surface Volumes* can be better than triangulation for other data sets such as volumes between existing and design contour maps

because making grids from contours can be more efficient than triangulating the contours.

Run *Volumes By Triangulation* from the Grading menu. For the Select Existing Surface Tmesh File dialog, choose BASE.tin. Next the program prompts at the command line whether to compare this tin with another tin or a flat elevation. Choose the default of TIN, and then select final.tin in the Select Final Surface Tmesh File dialog. At the prompts for the inclusion and exclusion perimeters, pick the perimeter polyline and press Enter for None for the exclusion. In the Volume Report Options, go with the defaults and pick OK. Then the volumes are calculated and the report is displayed.

Select final elevation or surface TIN [Elevation/<TIN>]? *press Enter*
Select Inclusion polylines.
Select objects: *pick the perimeter polyline*
Select objects: *press Enter*
Select Exclusion polylines.
Select objects: *press Enter*



Volumes by Triangulation (Prisms)
Original Surface: c:\Carlson2007\DATA\base.tin
Final Surface: c:\Carlson2007\DATA\final.tin

Area in Cut : 188.6 S.F., 0.00 Acres
Area in Fill: 24,947.0 S.F., 0.57 Acres
Area exactly in daylight: 49.5 S.F., 0.00 Acres
Average Cut Depth: 0.24 feet
Average Fill Depth: 3.53 feet
Total inclusion area: 25,185.0 S.F., 0.58 Acres

Cut to Fill ratio: 0.00
Cut (C.Y.) / Area (acres): 2.93
Fill (C.Y.) / Area (acres): 5648.09
Cut volume: 45.8 C.F., 1.70 C.Y.
Fill volume: 88,169.8 C.F., 3,265.55 C.Y.

Volume Method 5 - Calculate Section Volumes

Step 1 - Draw Centerline/Baseline:

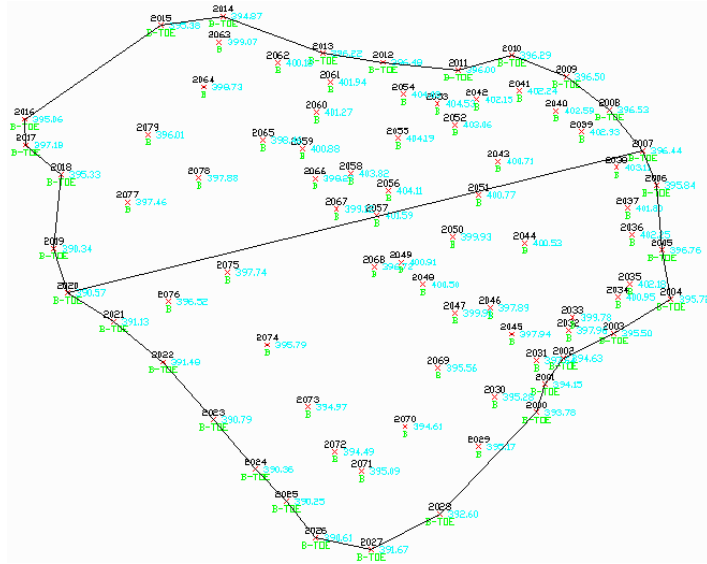
The first step for section volumes is to draw a polyline to use as the centerline for the section alignment. This centerline needs to be drawn so that the perpendicular section lines to the left and right of the centerline have a clear line to reach the perimeter without crossing and recrossing the perimeter.

Before drawing the polyline, run *Aperature-Object Snap* in the Settings menu, and turn on only the Node snap.

Choose *2D Polyline* under the Draw menu. If the options dialog is shown, make sure that the elevation is set to zero and pick OK. Then at the command line, the program prompts to pick the polyline points. Use the Node snap to pick point 2020 near the left of the stock-pile. Then use the Node snap to pick point 2007 near the right of the pile. Then press Enter to end.

[Continue/Extend/Follow/Options/<Pick point or point numbers>]: *pick point 2020*
[Arc/Close/Distance/Follow/Undo/<Pick point or point numbers>]: *pick point 2007*
[Arc/Close/Distance/Extend/Follow/Line/Undo/<Pick point or point numbers>]: *press Enter*

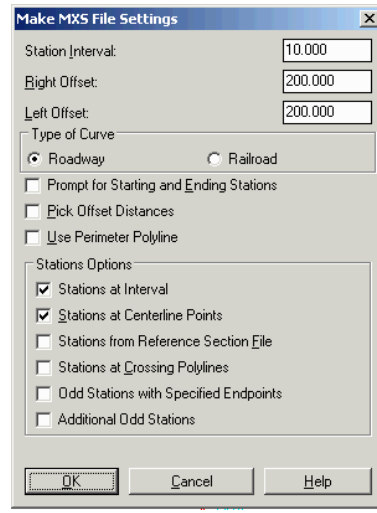
Go back to *Aperature-Object Snap*, and turn off the Node snap.



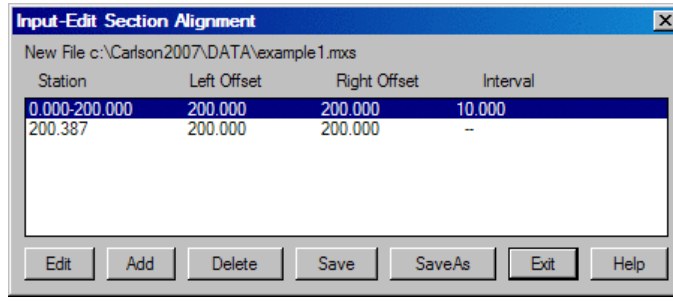
Step 2 - Define Section Alignment:

The next step is to define the station interval and left/right offsets for the sections. Choose *Input-Edit Section Alignment* from the Sections menu. In the Specify Section Alignment File dialog, choose the New tab and enter a file name of example1.mxs, and click Open. The program then prompts for the centerline. Pick the centerline polyline that we just drew. For the starting station of the centerline prompt, use the default of 0.
CL File/<Select polyline that represents centerline>: *pick the centerline polyline*
Enter Beginning Station of Alignment <0.00>: *press Enter*

Next there is a dialog to set the section parameters. Enter a station interval of 10. For volume calculations, go with a small station interval and make the computer work since it can calculate sections very quickly. You can have a small interval for calculations and still plot the sections at a bigger interval. For the left and right offsets, be sure to enter a distance that is enough to reach the perimeter. For this example, use offsets of 200. For the Station Options, turn on Stations At Interval and Stations At Centerline Points. When the dialog is set as shown, pick OK.

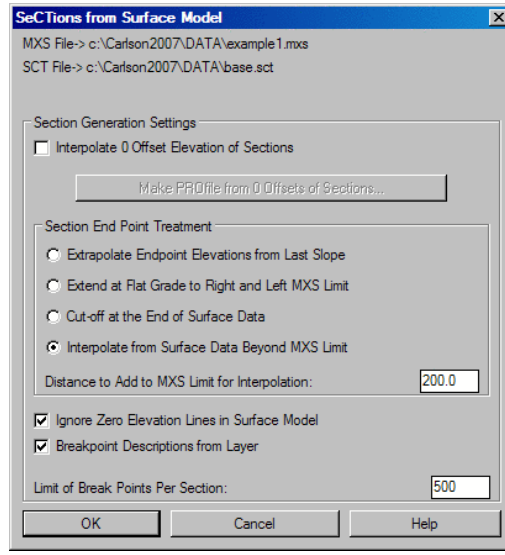


The program draws temporary lines in the drawing to show the positions of the sections. The next dialog shows a summary of the section alignment. Pick the Save button.



Step 3 - Create Section File for Base:

To create the section file for the stockpile base, run *Sections From Surface Entities* from the Sections menu. Select example1.mxs for the Section Alignment. For the Section File to Write, in the New tab area enter base.sct and click Open. Next, there is a Section From Surface Model options dialog. Let's use the defaults and pick OK.


SeCTions from Surface Model
MXS File-> c:\Carlson2007\DATA\example1.mxs
SCT File-> c:\Carlson2007\DATA\base.sct
Section Generation Settings
Interpolate 0 Offset Elevation of Sections
Make PROfile from 0 Offsets of Sections...
Section End Point Treatment
Extrapolate Endpoint Elevations from Last Slope
Extend at Flat Grade to Right and Left MXS Limit
Cut-off at the End of Surface Data
Interpolate from Surface Data Beyond MXS Limit
Distance to Add to MXS Limit for Interpolation:
200.0
Ignore Zero Elevation Lines in Surface Model
Breakpoint Descriptions from Layer
Limit of Break Points Per Section:
500
OK
Cancel
Help

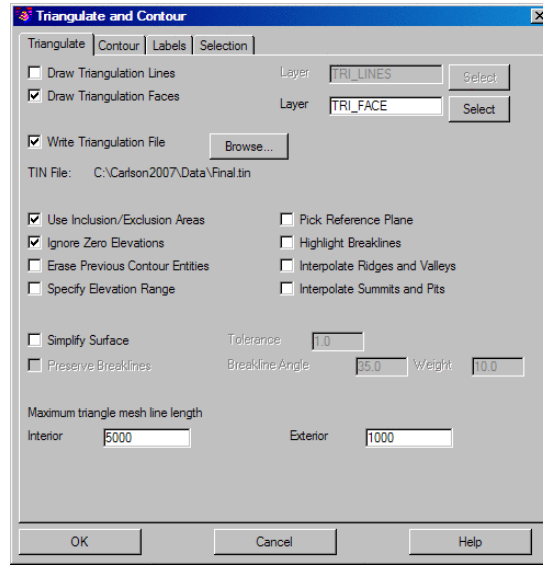
Then, the program prompts for the surface entities to use for the sections. Pick only the perimeter polyline.

Select Lines, PLines, and/or 3DFaces that define the surface.
Select objects: *pick the perimeter polyline*
Select objects: *press Enter*

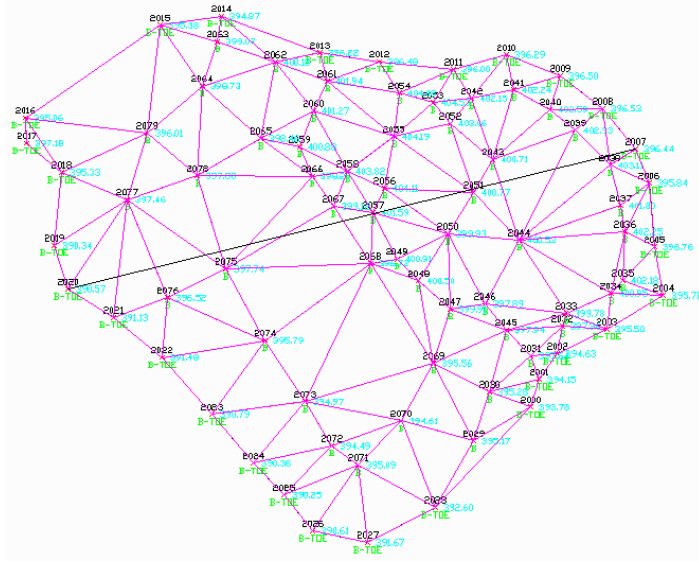
Step 4 - Triangulate & Contour:

The section creation routines can use a variety of data sources including drawing linework, surface files or points in section rows. For the base sections, we used the drawing linework, since we had the perimeter 3D polyline. For the stockpile sections, the stockpile points need to be processed because there isn't a section creation method from scattered points. The final.tin triangulation file from the Volumes By Triangulation step could be used to make the final sections. For practice, let's use another method of creating final surface linework to pull sections from.

From the Surface menu, run *Triangulate & Contour*. In the Triangulate tab, turn off the Write Triangulation File toggle. Then turn on Draw Triangulation Faces, Use Inclusion/Exclusion Perimeters and Ignore Zero Elevations. Then pick OK.



At the inclusion and exclusion perimeter prompts, choose the perimeter polyline for inclusion and nothing for exclusion. At the select objects to triangulate prompt, enter All and press Enter.
Select the Inclusion perimeter polylines or ENTER for none.
Select objects: *pick the perimeter polyline*
Select objects: *press Enter*
Select the Exclusion perimeter polylines or ENTER for none.
Select objects: *press Enter*
Select the points and breaklines to Triangulate.
Select objects: *All*
Select objects: *press Enter*



Step 5 - Create Section File for Stockpile:

To create the section file for the stockpile top, run Sections From Surface Entities from the Sections menu. Select example1.mxs for the Section Alignment. Click Open. For the Section File to Write, in New tab, enter final.sct and click Open. For the Section From Surface Model options dialog, use the defaults and pick OK.

For the surface entities to use for the sections, enter All to pick up the perimeter and the triangulation faces.

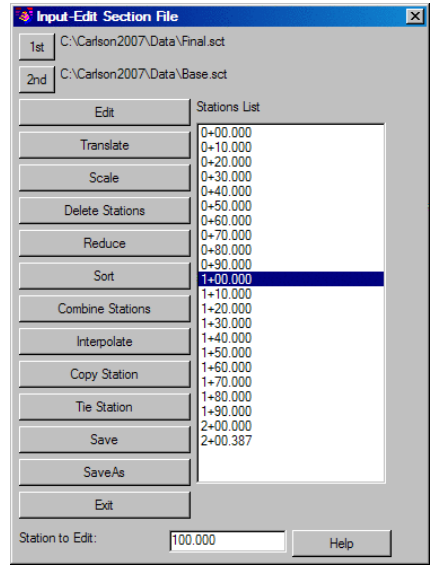
Select Lines, PLines, and/or 3DFaces that define the surface.
Select objects: *All*
Select objects: *press Enter*

Step 6 - Check Sections:

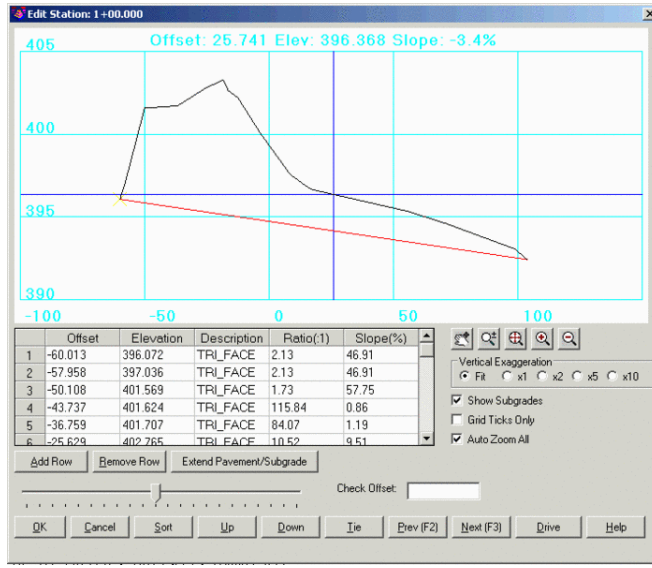
Similar to the Check Surfaces steps under Two Surface Volumes and Volumes By Triangulation, we have a couple surface files. Before running the volumes, this is an optional step to check that the surfaces are correct. There are several routines to check sections including Input-Edit Section

File, Draw Section File and Section To 3D Polylines.

For this check, run *Input-Edit Section File* under the Sections menu. For the Section file to process dialog, choose final.sct. Next the Input-Edit Section File dialog is displayed. Pick the button labeled 2nd, and choose the base.sct. Then highlight station 1+00 from the Stations List and double click on it or pick the Edit button.



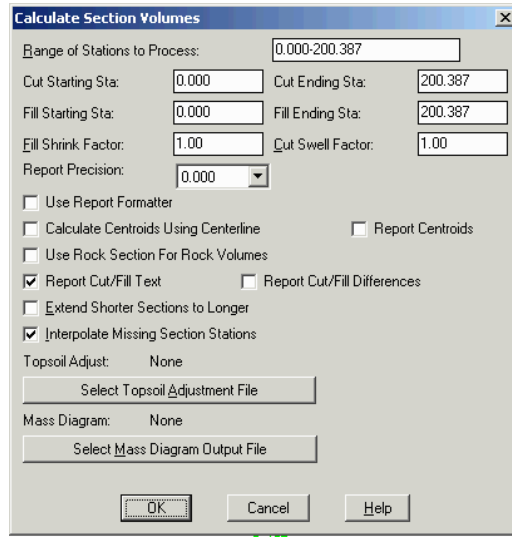
This brings up the Edit Station viewer for station 1+00. Use the Next and Prev buttons to look at other stations. After checking the stations, pick OK to exit Edit Station, and then pick Exit from the main dialog.



Step 7 - Calculate Section Volumes:

Now that we have our two section files, we can use Calculate Section Volumes, which does volumes by the average end area method which is a long standing industry standard method.

From the Sections menu, choose Calculate Section Volumes. For the Existing Ground Section File, choose base.sct. For the Final Ground Section File, choose final.sct. In the Calculate Section Volumes option dialog, use the defaults as shown.



Click OK. The volumes are calculated and reported, along with the cut and fill end areas at each station.

Calculate Section Volumes 5/7/2006 14:14

Ground Section> c:\Carlson2007\DATA\base.sct
Final Section> c:\Carlson2007\DATA\final.sct

Processing 0+00.000 to 2+00.387
Total Cut : 13.257 C.F., 0.491 C.Y.
Total Fill: 88440.707 C.F., 3275.582 C.Y.
Cut to Fill Ratio: 0.00

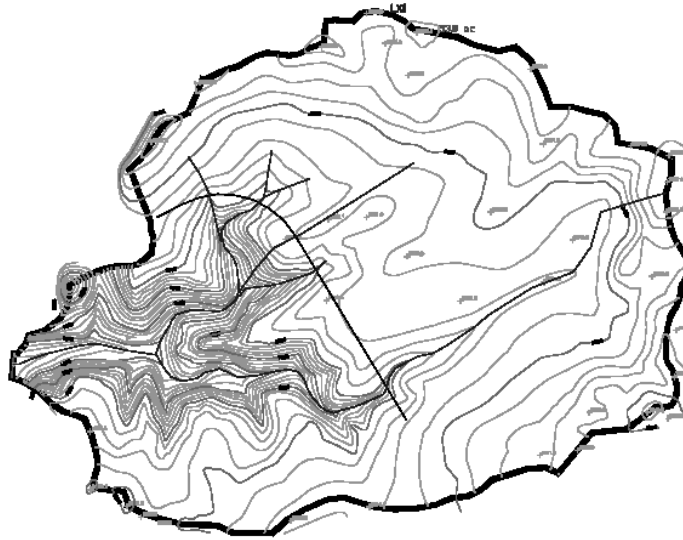
Station Cut(sf) Fill(sf) Interval Cut(cy) Fill(cy)
0+00.000 2.651 0.009
10.000 0.491 12.002
0+10.000 0.000 64.800
10.000 0.000 38.397
0+20.000 0.000 142.546
...

This completes the Lesson 10 tutorial: Calculate Volumes By Five Methods.

Lesson 10: Basic Road Design with Volumes

1 First we need to open an example drawing supplied with Carlson. Issue the File *Open* command and choose EXAMPLE2.DWG. It should be in the Carlson work folder, and will look like the example (without the curved road).

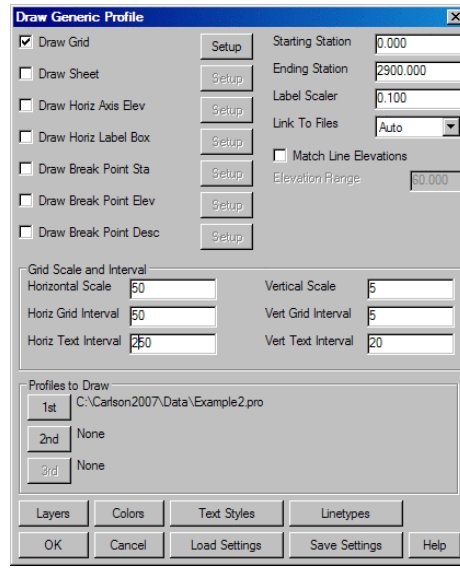
2 Draw Road Centerline. Issue the Draw > *2D Polyline* command and generate the road centerline as shown below. In this case it was drawn from the left, down and toward the right. Include a curve segment with the Arc option of the command.



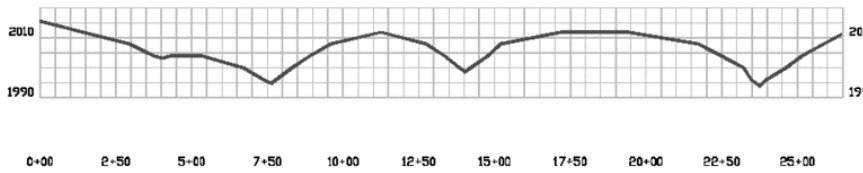
3 Profile from Surface Entities. Now we will make a profile file, ∗.pro. This will be from the centerline shown in the drawing as the lines with the curve. Under the Profiles menu choose *Create Profile From ...*, then *Profile from Surface Entities*. This will create a new file. Type in a file name in the dialog and click Save. On the next dialog, we will use the default values and click OK. Pick the centerline, and without hitting enter, select all of the contours. The data is written to file.

4 Draw Profile. This will give us a profile view of the contours at our centerline. Under Profiles, go down to *Draw Profile* and open our new file. The window will appear as shown. With the

horizontal scale set to 50 and the vertical scale set to 5, there will be a 10X vertical exaggeration of the profile. Fill this dialog box it out as shown below and click OK.

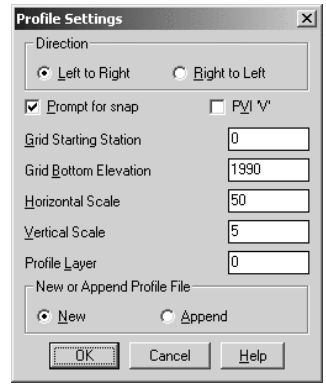


Next, there is the Profile Grid Elevation Range dialog. Accept the top and bottom elevations it gives by hitting OK. Pick a spot in the drawing to draw the profile, then view the profile on the grid by zooming as required. Your profile should look similar to this.



5 Design Road Profile. Now we will design how the road centerline profile will be, in relation to the existing ground (which is the first profile we have made). This routine will create another Profile file. Under Profiles, go to *Design Road Profile*, and then *Design Road On Profile Grid* (this method is suggested for this tutorial).

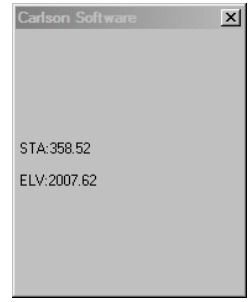
The following dialog box will appear. Since we followed up the *Draw Profile* command with this one, it was able to determine proper startup values for the dialog.



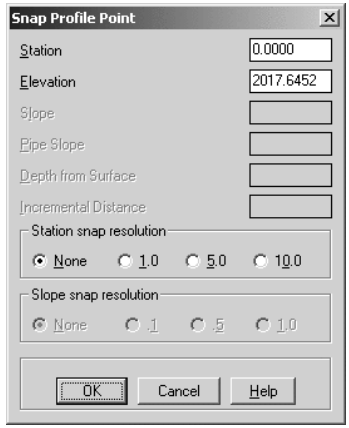
Choose OK on this dialog. A new file creation dialog box will appear, asking for an output file name. Enter a name such as DESIGN, and click Save.

Pick Lower Left Grid Corner <0.00,0.00>[endp on]: *Pick Lower Left Grid Corner* of the profile grid (Carlson has endpoint osnap active to make the pick accurate).

At this point another dialog will appear in the upper left corner. Initially, it will display only station and elevation. Once a beginning point has been designated, it will also display the relative difference from the last point to the cursor position. This can be an aid in determining acceptable slopes for your design.

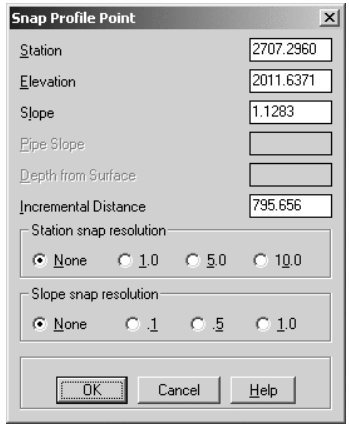


Enter a station or pick a point (Enter to End): *ENDof* (pick the left-most endpoint of the existing ground profile as a tie in point). The following dialog will appear, choose OK to accept the defaults.



Station of second PVI or pick a point (U,E,D,Help): *1111.01*
Percent grade entry/<Elevation of PVI>: *1999.37*
Station of next PVI or pick a point (U,E,D,Help): *1911.64*
Percent grade entry/<Elevation of PVI>: *2002.66*
View table/Unequal/Through pt/Sight dist/K-value/<Vert Curve Length>: *500.00*
For Sag with Sight Distance>VC and Vertical Curve => 500.00
Sight Distance => 2334.40, K-value => 243.2
Use these values (<Y>/N)? *Y*
Station of next PVI or pick a point (U,E,D,Help): *END*of (pick the far-right endpoint of the existing road as a tie in point).

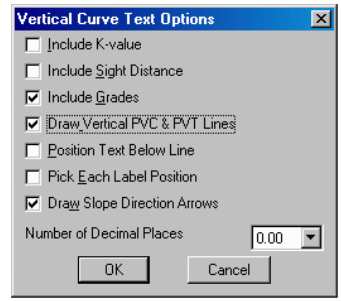
The following dialog appears. Choose OK to accept the defaults.



View table/Unequal/Through pt/Sight dist/K-value/<Vert Curve Length>: *500.00*

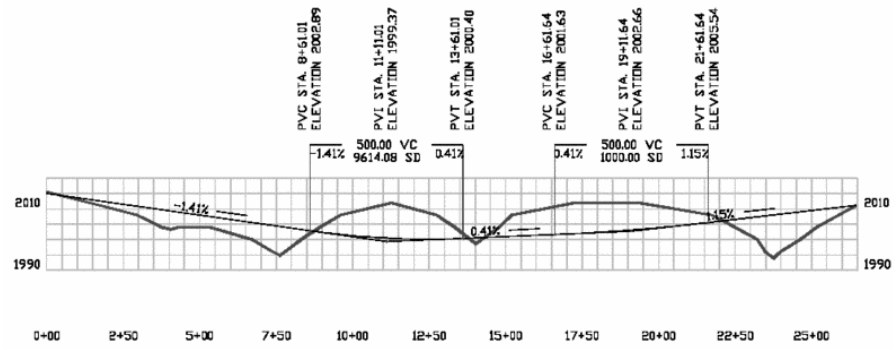
For Sag with Sight Distance>VC and Vertical Curve => 500.00
Sight Distance => 1000.00, K-value => 697.0
Use these values (<Y>/N)? *Y*
Station of next PVI or pick a point (U,E,D,Help): *press Enter*

At this point the following dialog appears. Change settings to match, and choose OK.



Pick vertical position for VC text: *pick a point above the top of the grid*

Carlson will now finish the road design, and your drawing should like the following:



6 Polyline to Centerline File. This step will create a centerline file necessary for the final road design routine. We will do the simplest variation, which is simply picking a polyline. There are other methods to design a centerline. They are documented in the manual.

First (if necessary), zoom back to the plan view area, as we will be working with the polyline first created in this exercise. Go to *Polyline to Centerline File* command, under Centerline, and name a ∗.cl file to create.

Beginning Station <0+00>: *press Enter*
Polyline should have been drawn in direction of increasing stations.

Select polyline that represents centerline: *pick the plan-view polyline*

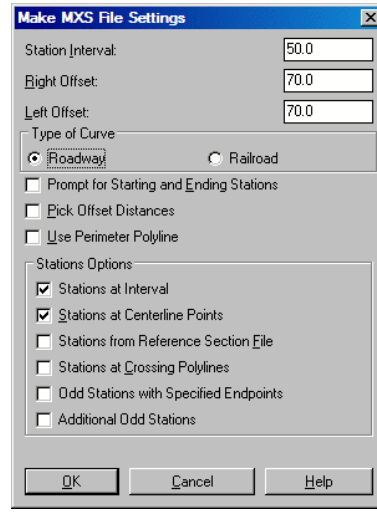
```
 Station       North(y)         East(x)          Description
----------------------------------------------------------

 0.0000        159460.9658      1857580.2082     LI

446.2825      159541.3445      1858019.1926     PC

1178.1130     159254.1689      1858643.2229     LI

2707.2962     157932.5436      1859412.4483     LI
```

Press ENTER to continue. *press Enter*

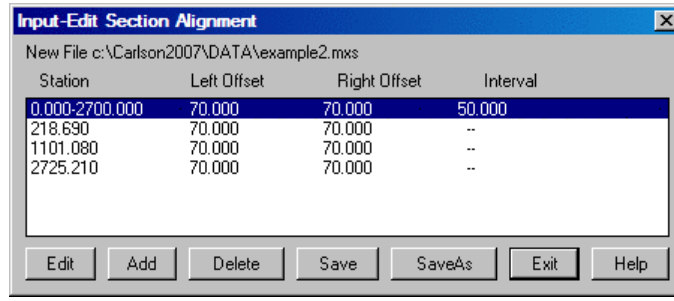
7 Input-Edit Section Alignment. Now we will layout the alignment for our cross-section file. This step gives the section interval, and the offset left and right from our centerline. Under Sections, go to *Input-Edit Section Alignment*. Choose the New tab, which brings up the dialog to make a new MXS file (multi-xsection file). Type in a new name and click Open. Notice how all files can have the same name in this road design portion, as they all have a unique file extension. So for the organization of various jobs, it is sometimes helpful to have all of the files with the same name.

Polyline should have been drawn in direction of increasing stations.
CL File/<Select polyline that represents centerline>: *pick the centerline polyline*
Enter Beginning Station of Alignment <0.00>: *press Enter*

The dialog will appear as shown, enter in the stations and offsets exactly as they appear here. This will give the needed detail for the road design routine.

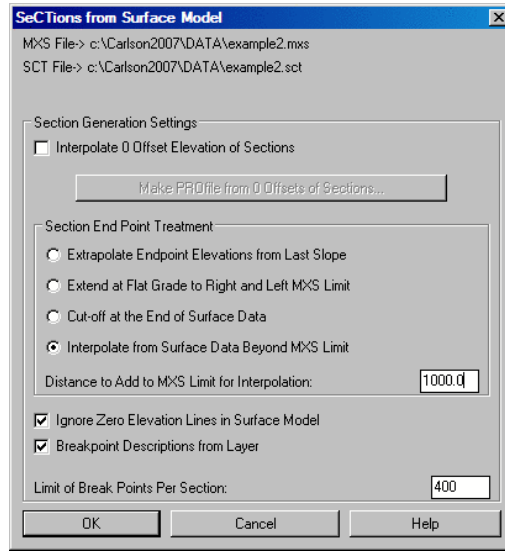


Choose OK, and another window appears that allows for any station editing or changes. It all looks good here, so hit Save.



The Alignment file is now written. There is now a preview of the section alignment lines shown on the centerline. These are just images, if the drawing is regenerated, they will disappear. (They can be drawn permanently if desired.)

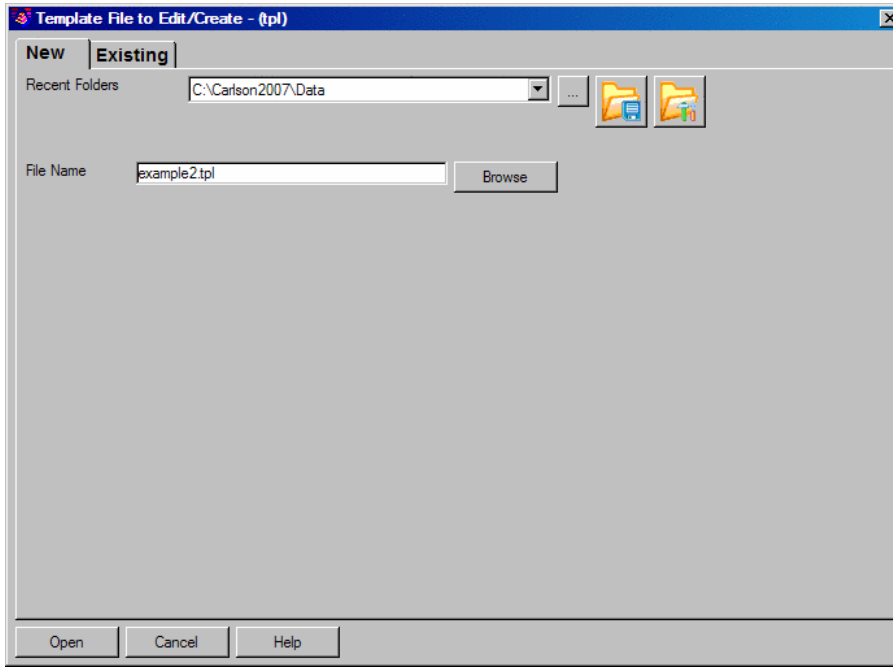
8 Sections from Surface Entities. Next, we will create the actual section file (∗.SCT) from the contours, in combination with the alignment file (∗.MXS). Under Sections, go to *Sections from Surface Entities*. We will use the contours and breaklines for surface elevations, as we did with generating the profile. Specify the MXS file that we just created to read for the alignment. Click Open to select it. Then choose a new file name for the section file, and click Open.


SeCTions from Surface Model
MXS File-> c:\Carlson2007\DATA\example2.mxs
SCT File-> c:\Carlson2007\DATA\example2.sct
Section Generation Settings
Interpolate 0 Offset Elevation of Sections
Make PROfile from 0 Offsets of Sections...
Section End Point Treatment
Extrapolate Endpoint Elevations from Last Slope
Extend at Flat Grade to Right and Left MXS Limit
Cut-off at the End of Surface Data
Interpolate from Surface Data Beyond MXS Limit
Distance to Add to MXS Limit for Interpolation:
1000.0
Ignore Zero Elevation Lines in Surface Model
Breakpoint Descriptions from Layer
Limit of Break Points Per Section:
400
OK
Cancel
Help

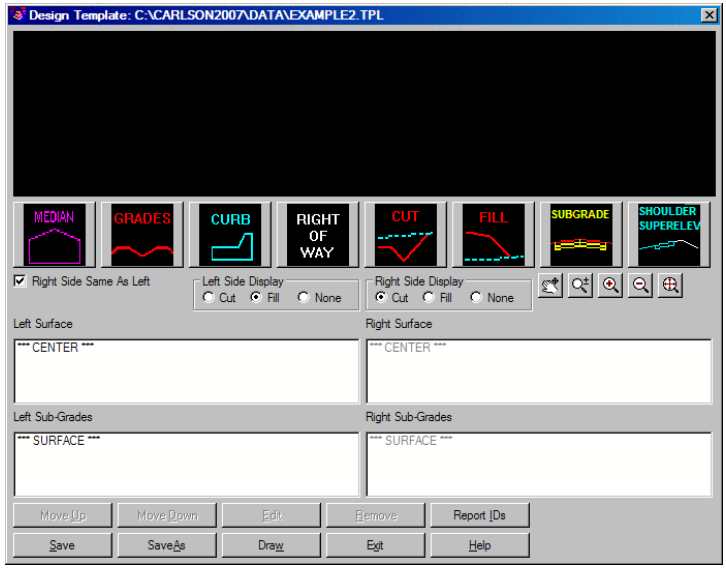
We'll enter in a distance of 1000 feet to add to our MXS limit of 70. This will search farther for contour elevations, then choose OK. Now, select the surface entities which are the contours and the breaklines. Once you are back to the command prompt, you are done with the making of sections.

9 Design Template. Let's design a wide boulevard, 30' of drivable pavement, with curb and gutter on the outside. Whenever a cut is within rock, the cut slope will go from a typical 2:1 to 0.5:1. At the top of rock, the cut will continue on at 2:1. In fill, the condition will be 3:1in all fill under 6' and 2:1 in all fill over 6' in depth. Pavement depths will be 8 of stone and 4 of asphalt.

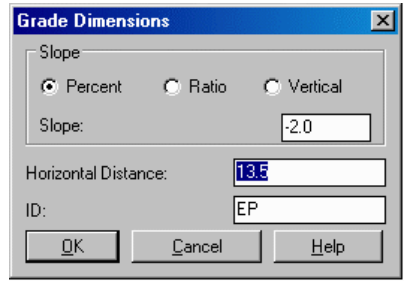
First, Select *Design Template*, found under Roads, within the Civil Design module of Carlson. Click on the New tab.



We'll give it the same name as the drawing. Choose Open. A large dialog box appears as shown below. In it, you enter segments of the template, which work outwards from the middle as you add more lanes, curbs and shoulders. We will enter a symmetrical template, with 13.5' pavement sections either side of centerline, connecting to a 2' curb and gutter, with 18" of gutter and 6" of curb. Then we'll add a 6' shoulder.



For the lanes, click the Grades icon. This leads to a child dialog as shown next:

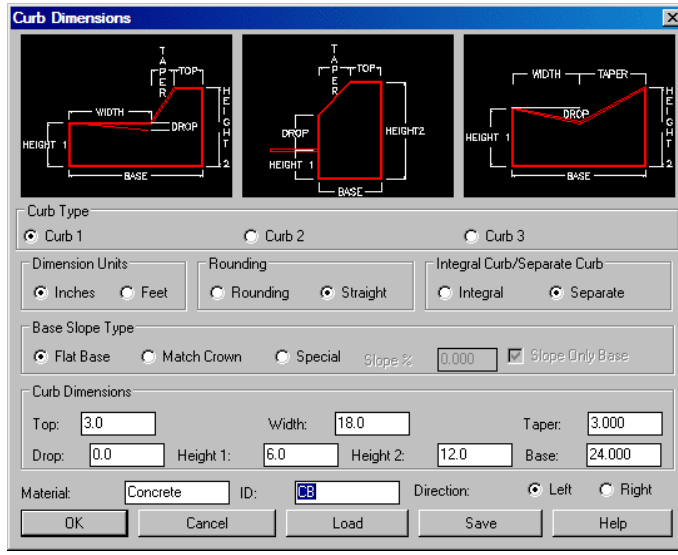


Fill out as shown. Its important to note that a downhill pavement from a crown in the middle is entered as a negative slope. That is, it is 2% heading from centerline outward, regardless of which side of centerline we are speaking of. Slope is in reference to the centerline of the template, and it is independent of the profile grade point. It is also important to enter an ID whenever requested. ID's can be referenced later.

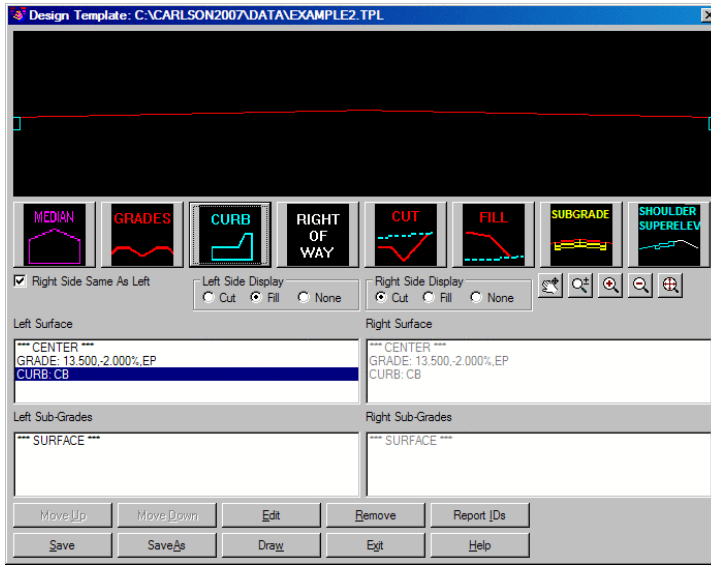
A break point in a shoulder in superelevation could be defined as occurring at EP+3, as opposed to the exact offset distance from centerline. The advantage of EP+3 is that if the road lane width expands (e.g. for a passing lane), but the shoulder always breaks 3 feet beyond edge of pavement, then EP+3 is the only effective way to reference the break point. Now click OK. You'll note that

the lanes show up in the preview window at the top.

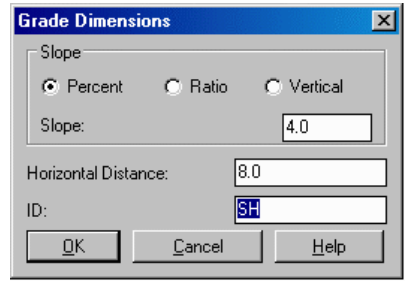
Next, we will add a curb. Click the Curb icon. Fill out as shown:



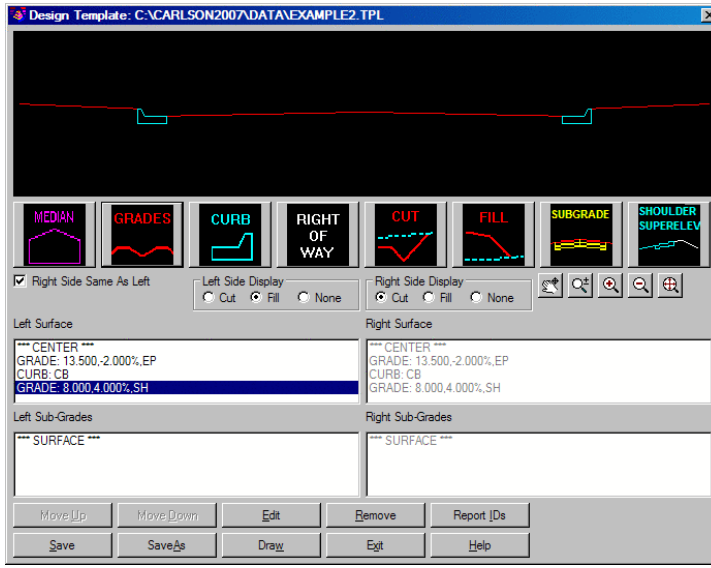
It is especially a good idea to match crown – to make the curb match the slope of the last pavement lane (2% above). But if your curb tilts downward more (like 3%), then use a Special Base Slope Type. If it is flat, by all means click on Flat Base. Now click OK. Here's what our screen looks like so far:



Next, we will add a shoulder, going uphill at 4% for 8'. Notice what is happening. You are lit up on the Curb line, so if you add another Grade, it will append after the curb, and add to the back of curIf you were to click on the GRADE: 13.500, -2.000%, EP line, highlight it, then click on GRADES, you would add a second lane before the curb. Now click on GRADES. Fill out the dialog as shown:



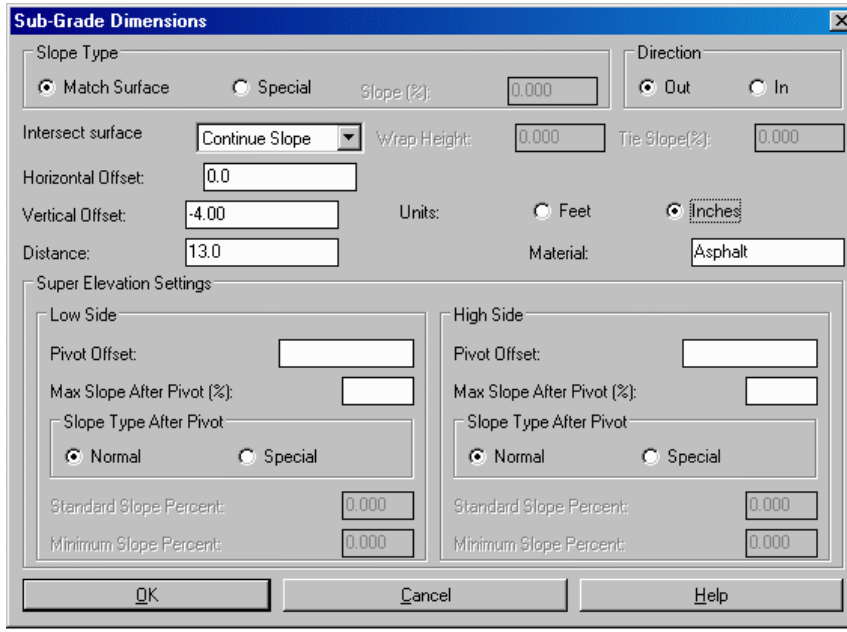
That's it for the surface! Here's what our screen looks like now:



Now we have subgrades and outslopes still to consider. Let's turn our attention to subgrades. Let's think about this: if our pavement is a total of 12 deep (8 stone, 4 asphalt) and our concrete gutter is 6 deep, then the stone will run 6 deep under the gutter. Do we want this stone to come back up at the back of the gutter, behind the gutter, or even wrap around back into the gutter, like a layer of bedding that is covered by dirt. The most complex concept is the wrap around, so let's go for it.

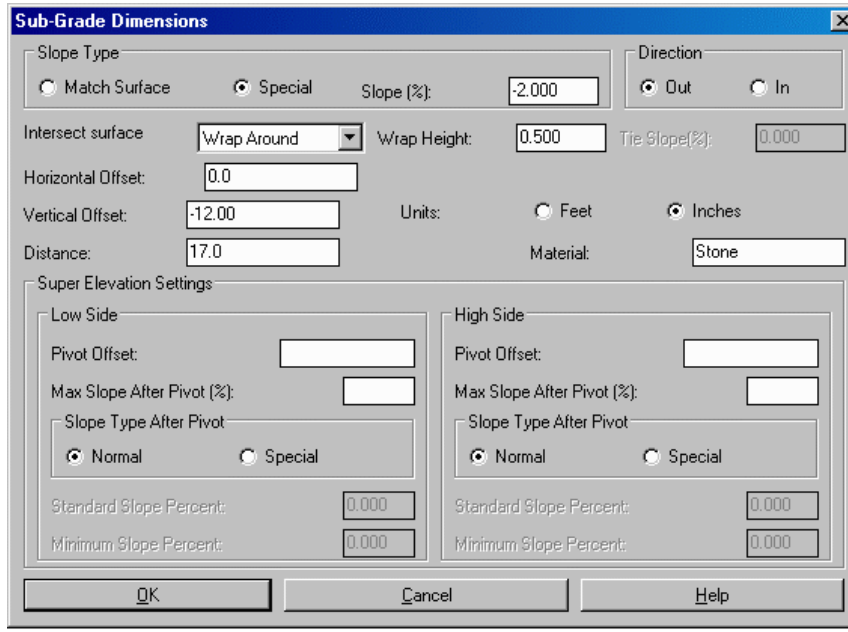
Select the Subgrade icon, second from the right (yellow color). We'll do two subgrades: first asphalt, which will run straight out and hit the curb, and then stone, which will run out, go under the curb, and wrap back.

For any sub-grade, we still do the vertical offset as a negative distance (negative meaning down). But follow this concept: we start it out 13 feet from offset 0, and keep going at "Continue Slope" until it hits something (the curb). This won't work if there is nothing to hit. But it will run into the curb. Or if there is a fill slope, downhill 6:1 recovery zone lane, or something to intersect, it will also. This Continue Slope concept works perfectly for shallow asphalts and concretes that will bump into a curb, when extended.

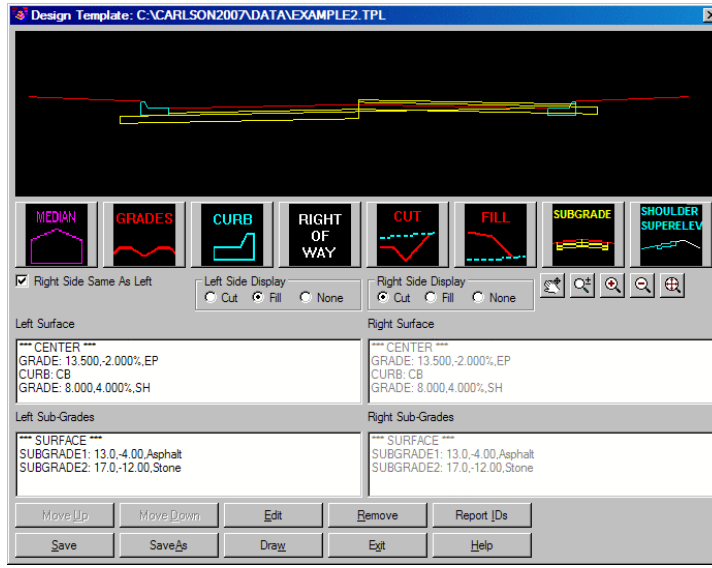


Complete as shown above, and click OK.

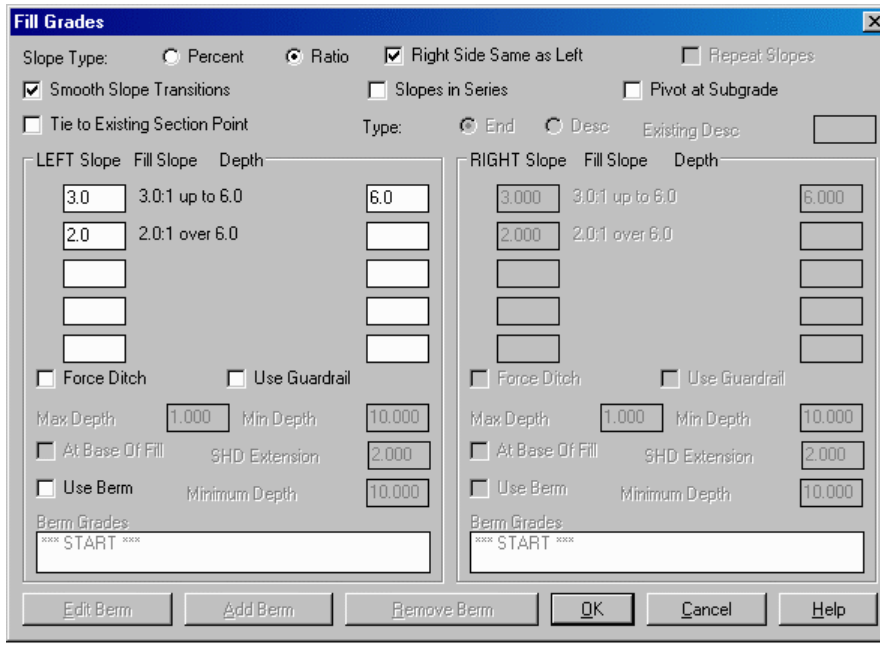
Now for the other subgrade: the stone beneath the asphalt. Follow this: if the stone can't Match Surface (note this option under Slope Type), it will start up hill with the shoulder as it passes beyond the curb (it goes out 17'). So it must have a Special Slope Type, the same 2% all the way. The Wrap Height is the vertical rise at the end of the 17', before it wraps back and hits the curb. Select the Subgrade icon again (second from the right).



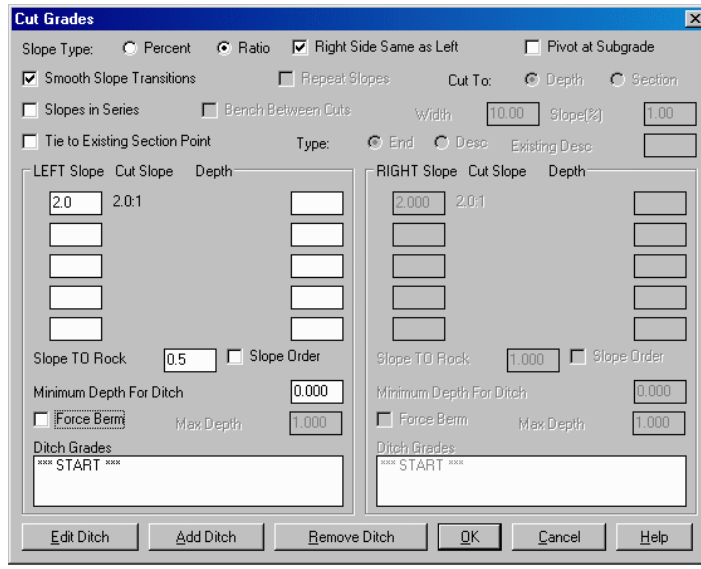
Fill out the Sub-Grad Dimensions dialog, as shown above, and click OK. Note the preview screen:



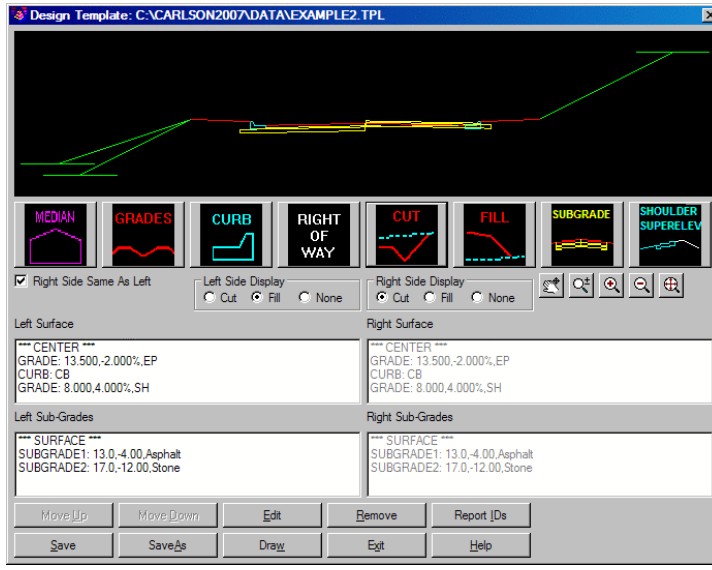
We still need to enter the outslope conditions. They are done with the Cut and Fill icons. Fill is easy in our example. Click on Fill.



Just 3 entries total: 3 (for 3:1), 6 (up to 6'), then 2 (for 2:1 over 6'). Click OK. Next, click the icon for Cut.

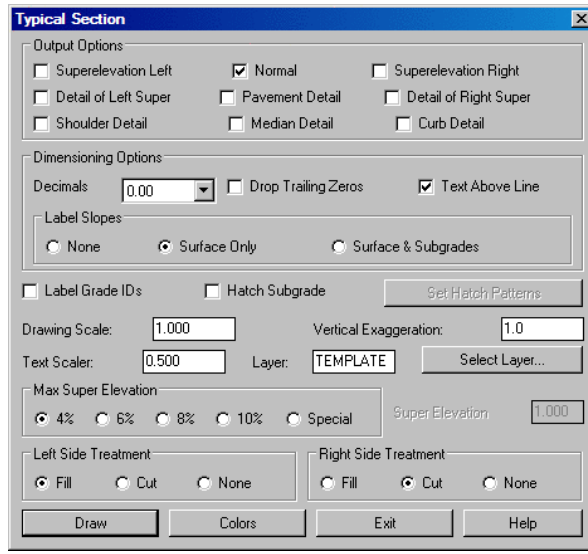


This is actually easier (in terms of total entries). Just 2 entries do it: 2 (for 2:1 normal cut) and down below, 0.5 (for 0.5:1 cut when in rock). Click OK.

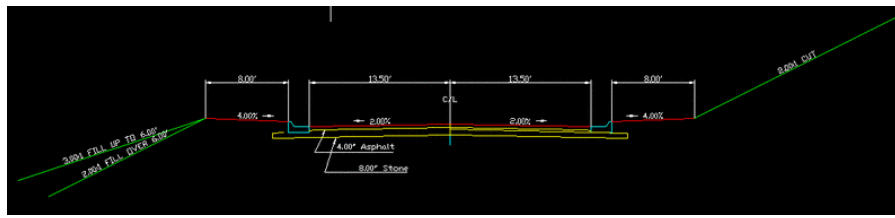


The template is complete, so click Save. Now let's prove we have a good template by doing the command Draw Typical Template.

10 Draw Typical Template. The file extension for templates will be tpl. Select *Draw Typical Template* under the Roads pulldown menu, select Example2.tpl (or as named above), choose Open and the following dialog shown here is displayed:

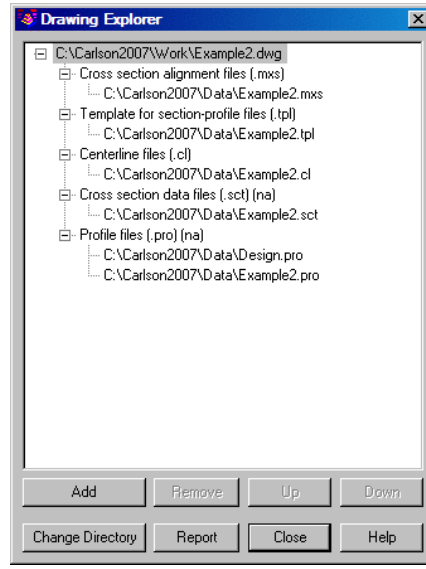


We have doubled the text scaler to 0.5 for better appearance in this tutorial. Click on Draw, and pick a starting position point. Here is the look of the plotted template.

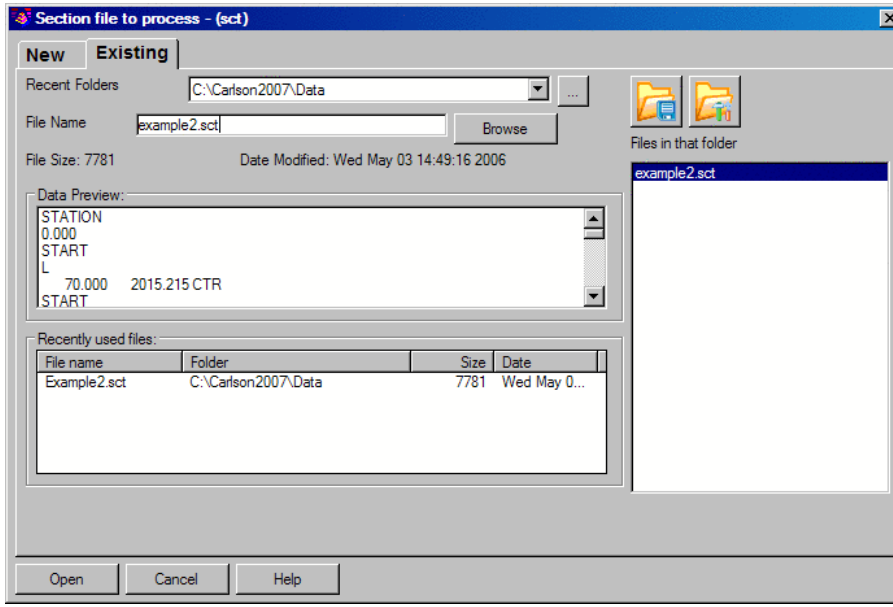


11 Drawing Explorer. As more files are created, edited, loaded and reviewed within a work session, the drawing ini file takes note. You can review your active files as you work, or days

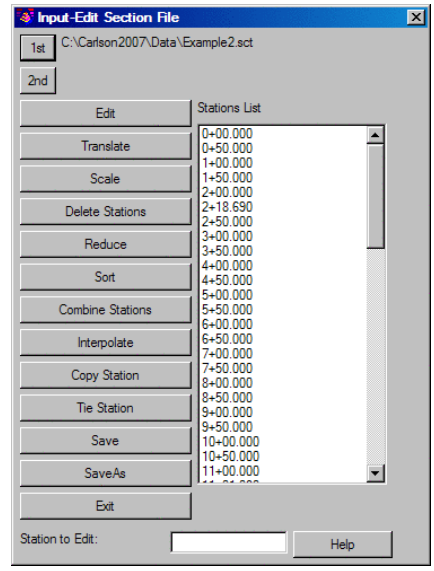
later, because they save to the ini file that shares the same name as the drawing file. To see the files associated with this tutorial drawing file, select *Drawing Explorer* by sliding over from Project, under the Settings menu.



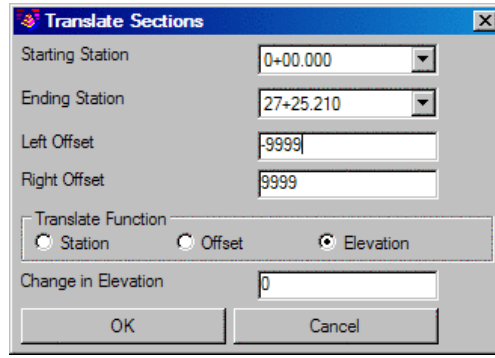
12 Input-Edit Section File. *Input-Edit Section File* has many uses. One of them is to translate or lower the elevations of a file and re-save. If we lower the elevations of our ground sections 8 feet, we can call that the rock line. Rock lines react with templates and profiles to create rock cuts and rock quantities, within the final step, which is called Process Road Design (Step 13). Select *Input-Edit Section File* under the Section pulldown menu. Under the Existing tab section, select the SCT file you created earlier and click Open.



The next dialog that appears is shown below:



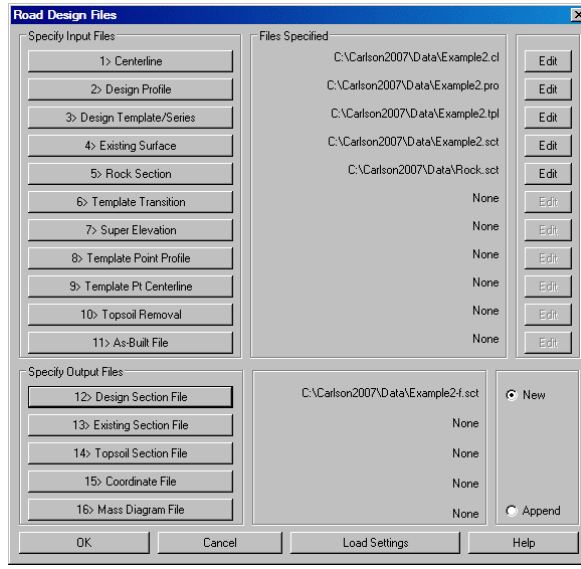
Click the Translate button. The Translate Selections dialog appears. The Ending Station might differ from what is showing here, but it should be close to this value. Make sure the rest of the dialog looks that same as shown below, and click OK.



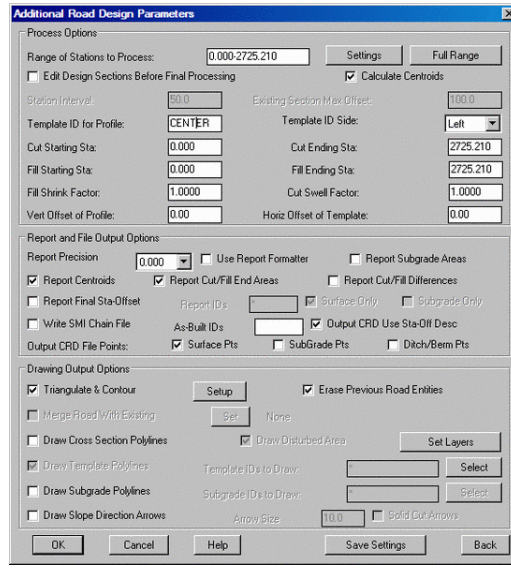
Now back at the Input-Edit Section File dialog, click Save As, and enter a different name, such as Rock, and save the file. Then click Exit.

Input-Edit Section can do much more through the Edit option. In the case of Edit, you would first highlight one station, then click Edit to review and revise it.

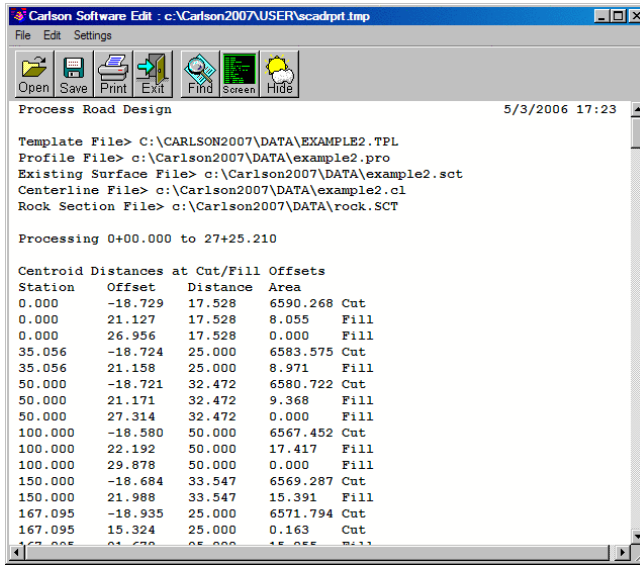
13 Process Road Design. This is the routine that weaves everything together. Select *Process Road Design*, as the lower command under the *Roads* pulldown in the Civil Design module. Fill out the dialog as shown below. Be sure to select, under Specify Output Files, the Section File option and click New. Enter a new file name and Save. Then click OK.



On the next dialog, be sure to click on Triangulate & Contour at the lower left of the dialog.



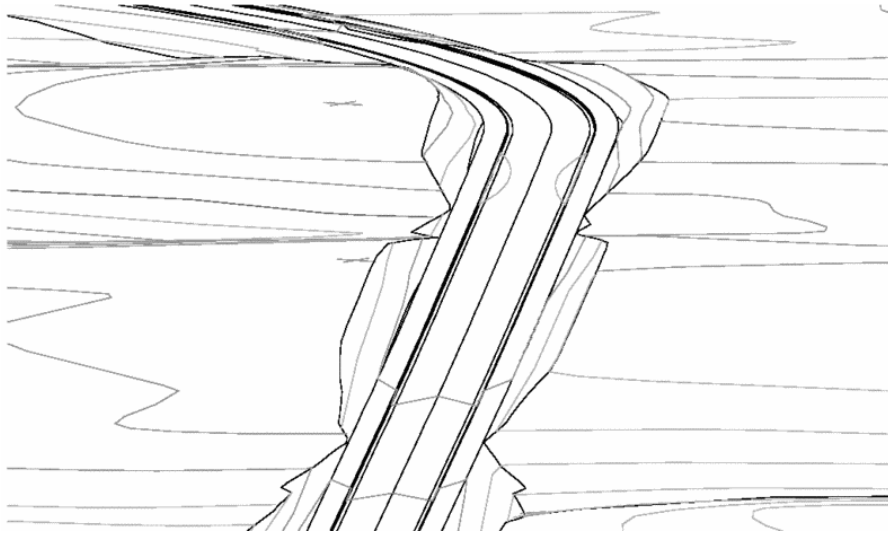
Now click OK. Here is a partial view of the final report, with itemized quantities:


Carlson Software Edit : c:\Carlson2007\USER\scadrprt.tmp
File Edit Settings
Open Save Print Exit Find Screen Hide
Process Road Design 5/3/2006 17:23
Template File> C:\CARLSON2007\DATA\EXAMPLE2.TPL
Profile File> c:\Carlson2007\DATA\example2.pro
Existing Surface File> c:\Carlson2007\DATA\example2.sct
Centerline File> c:\Carlson2007\DATA\example2.cl
Rock Section File> c:\Carlson2007\DATA\rock.SCT
Processing 0+00.000 to 27+25.210
Centroid Distances at Cut/Fill Offsets
Station Offset Distance Area
0.000 -18.729 17.528 6590.268 Cut
0.000 21.127 17.528 8.055 Fill
0.000 26.956 17.528 0.000 Fill
35.056 -18.724 25.000 6583.575 Cut
35.056 21.158 25.000 8.971 Fill
50.000 -18.721 32.472 6580.722 Cut
50.000 21.171 32.472 9.368 Fill
50.000 27.314 32.472 0.000 Fill
100.000 -18.580 50.000 6567.452 Cut
100.000 22.192 50.000 17.417 Fill
100.000 29.878 50.000 0.000 Fill
150.000 -18.684 33.547 6569.287 Cut
150.000 21.988 33.547 15.391 Fill
167.095 -18.935 25.000 6571.794 Cut
167.095 15.324 25.000 0.163 Cut

Click Exit when finished reviewing the report. You will get this command prompt:

Trim existing contours inside disturbed area [Yes/<No>]? *press Enter*

Here is the resulting graphic, in 3D, obtainable by using *3D View Window*, found under the View pulldown:



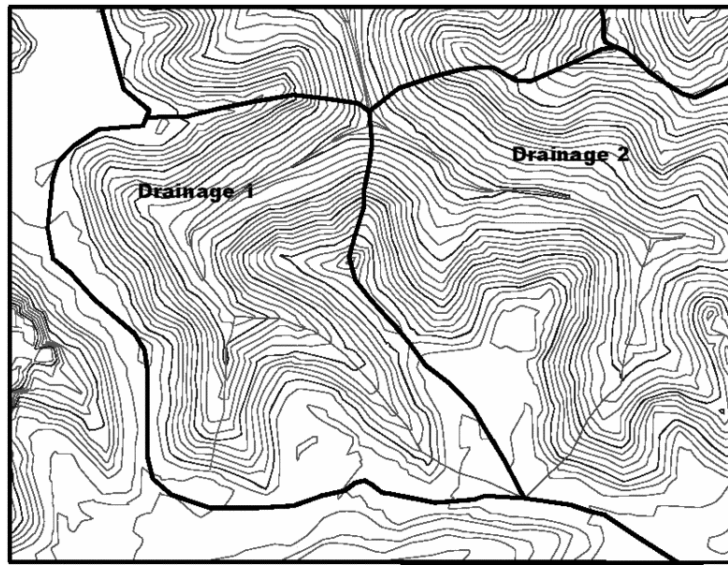
This completes the Lesson 10 tutorial: Basic Road Design with Volumes.

Lesson 11: Hydrology and Watershed Analysis

This lesson will step through some of the more common Hydrology module routines, and design structures based on the analysis of the watershed. The drawing file HydroLesson.dwg is a nice example to show the features of the Hydrology Module. A surface topography grid file is needed for these routines, and is supplied also.

Open HydroLesson.dwg. After opening the drawing, take a look around at the various layers, and then go to the *3D View Window*, under View, to see the change of elevations in the surface.

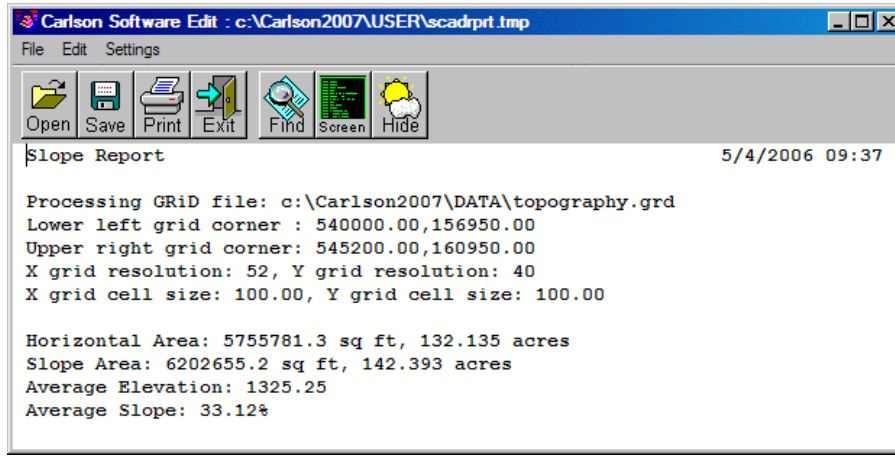
There are two main drainages that we will be looking at: Drainage 1 and Drainage 2. They are labeled in the below graphic. The other drainages in this region will be ignored, as they do not drain to the same area we are looking at, the north central low spot.

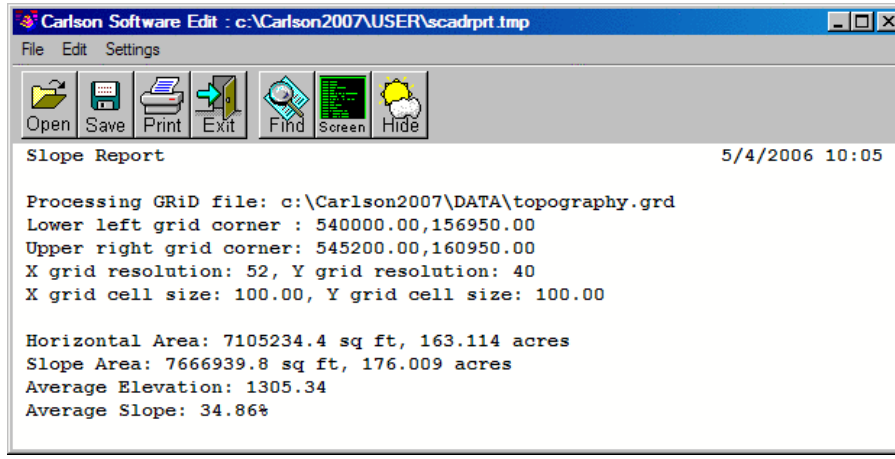


There are routines for finding these watersheds based on grid or TIN files, but this drawing has the closed polylines already generated. We will walk through some of the steps to gather the slope and area information.

1 Slope Report. Go to View and use Freeze Layer to freeze all contours, which are on two separate layers. Then freeze the Watershed_Perim layer. We will run the following routine twice, once for each watershed. Go to the Surface pulldown menu in the Hydrology module. From the Surface menu, choose *Slope Report.* Choose the Slope report by area option, which is the default, and you will be prompted for File or Screen. Choose File, and notice that we have the Topography.grd file, found in the \DATA folder, to analyze. Open it.

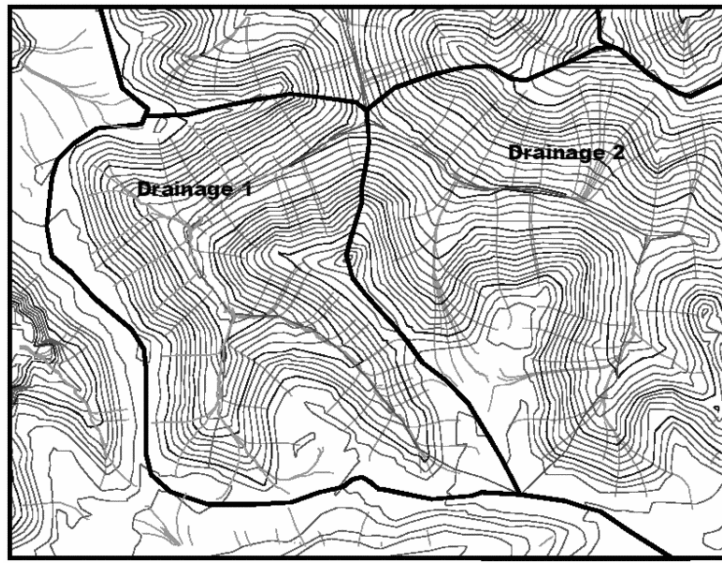
When prompted for the inclusion line, select the closed perimeter line that runs around Drainage 1. The report window will appear, and the information can be saved to a file, placed on-screen, or simply reviewed here using the Carlson Standard Report Viewer. In this example, we will review the reports in the viewer. Next, analyze and report on the Drainage 2 watershed, again using Topography.grd. Shown in the following figures are the reports of the two drainages.


Carlson Software Edit : c:\Carlson2007\USER\scadrprt.tmp
File Edit Settings
Open Save Print Exit Find Screen Hide
Slope Report 5/4/2006 09:37
Processing GRiD file: c:\Carlson2007\DATA\topography.grd
Lower left grid corner : 540000.00,156950.00
Upper right grid corner: 545200.00,160950.00
X grid resolution: 52, Y grid resolution: 40
X grid cell size: 100.00, Y grid cell size: 100.00
Horizontal Area: 5755781.3 sq ft, 132.135 acres
Slope Area: 6202655.2 sq ft, 142.393 acres
Average Elevation: 1325.25
Average Slope: 33.12%

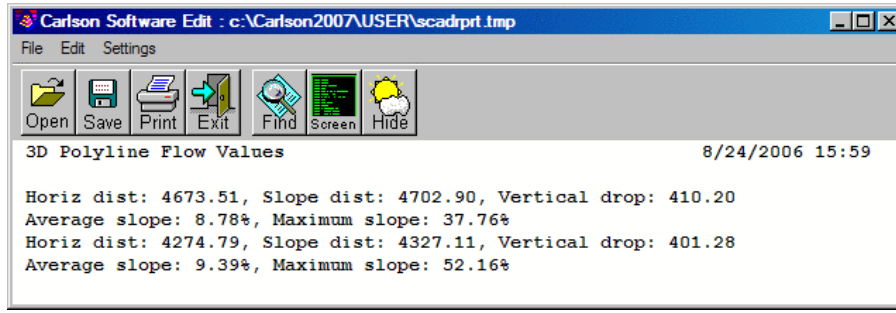

Carlson Software Edit : c:\Carlson2007\USER\scadrprt.tmp
File Edit Settings
Open Save Print Exit Find Screen Hide
Slope Report 5/4/2006 10:05
Processing GRiD file: c:\Carlson2007\DATA\topography.grd
Lower left grid corner : 540000.00,156950.00
Upper right grid corner: 545200.00,160950.00
X grid resolution: 52, Y grid resolution: 40
X grid cell size: 100.00, Y grid cell size: 100.00
Horizontal Area: 7105234.4 sq ft, 163.114 acres
Slope Area: 7666939.8 sq ft, 176.009 acres
Average Elevation: 1305.34
Average Slope: 34.86%

Notice that the watersheds are similar in size, and have approximately the same average slope. Thaw the layers that you froze earlier.

2 Run Off Tracking. The command *Run Off Tracking* is found under the Watershed pulldown. It will draw a 3D polyline running downhill in the path that a storm event would. It is useful to fine-tune a watershed boundary. If you pick near the boundary line, you can see which direction the water will flow. Shown is an example of the drawing with the runoff tracking lines falling within their respective watersheds. There might be a little overlap in certain areas where the grid cells are horizontally flat.

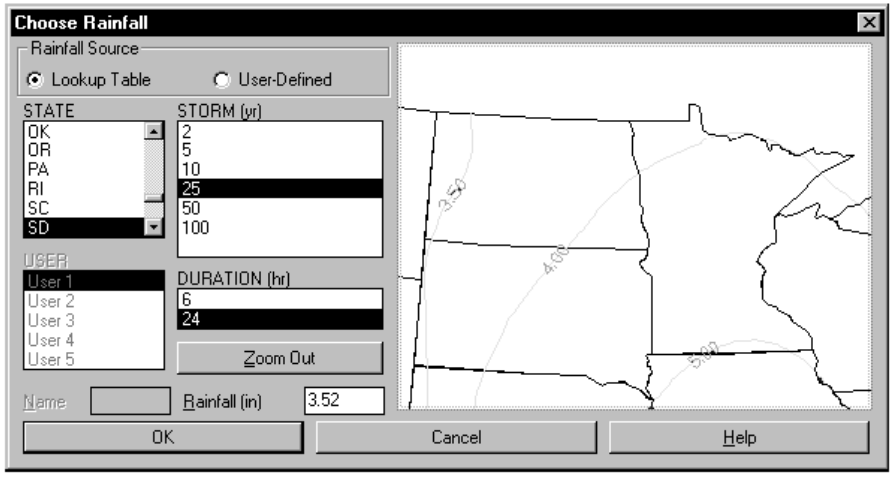


3 3D Polyline Flow Values. This is a step to see what the longest flow line data is within the watersheds. It will create a nice report showing the slopes and vertical drop. The 3D polylines in the drawing were created (with runoff tracking and some editing) to represent the longest flow line. This routine reports out the values of the polylines selected. Go to the Watershed pulldown to *3D Polyline Flow Values*. The report can be saved for future reference, but also be aware that when you will need to enter in this data, there is a button on the dialog to simply pick the polylines on-screen.

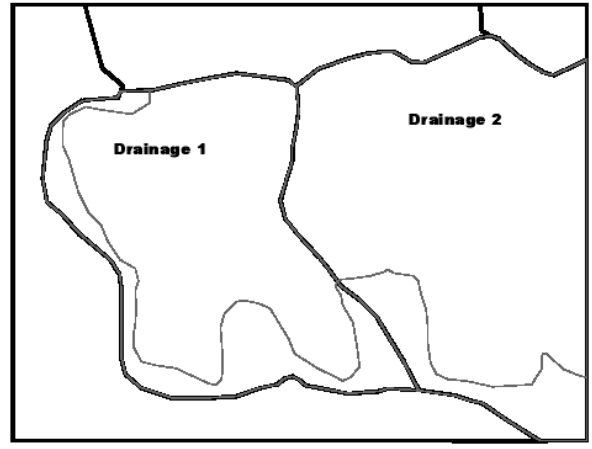

Carlson Software Edit : c:\Carlson2007\USER\scadrprt.tmp
File Edit Settings
Open Save Print Exit Find Screen Hide
3D Polyline Flow Values 8/24/2006 15:59
Horiz dist: 4673.51, Slope dist: 4702.90, Vertical drop: 410.20
Average slope: 8.78%, Maximum slope: 37.76%
Horiz dist: 4274.79, Slope dist: 4327.11, Vertical drop: 401.28
Average slope: 9.39%, Maximum slope: 52.16%

4 Rainfall Frequency & Amount. This routine will look up rainfall depths based on what storm type and duration is being analyzed. Under Watershed, go to *Rainfall Frequency & Amount*. We will do the 25 year, 24 hour storm. Let's assume the area is somewhere in South Dakota, and so we will use the value of 3.52 inches. For customizing this table to suit your needs, there is the

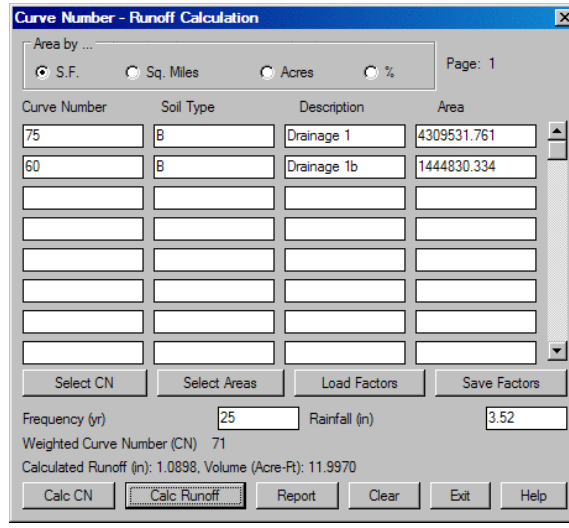
user-defined portion in the lower left corner, if you have specific values you always use, they can be entered here for quick retrieval.



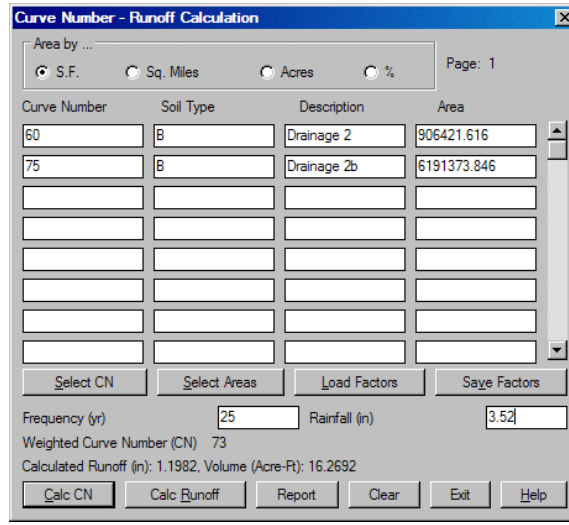
5 Sub-Watersheds by Land Use. This is another way to break up the watersheds, based on land use, or varied surface features. We will break up our watersheds into two types of land use. The steep slopes will be treed, and the top flats will be vegetated with grasses. Go to*Sub-Watersheds by Land Use,* under the Watershed pulldown. The routine will then ask for the watershed boundary, and the two closed polylines that make up the two different areas. Pick the lines as prompted. The two lines are drawn in layer PILLARS so that the program knows how to identify them.



6 Curve Numbers (CN) & Runoff. This is an easy step to get the runoff and volume of the storm based on the CN and acreage. We will do a weighted curve number representing out two land use types. We will run this twice, once for each watershed. Go to *Curve Numbers (CN) & Runoff* under the Watershed pulldown. First off, Select Areas, and pick the two lines inside Watershed 1. They will have two different CN, based on the type of land. The area is brought in automatically, and the CN will have to be typed in, or looked up on the table. After the CN numbers and the areas are in, hit the Calc Runoff button, and the runoff and volume will appear at the bottom. These can be saved in a report, or simply written down for future reference.

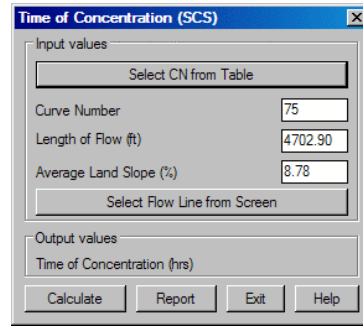


Drainage 1

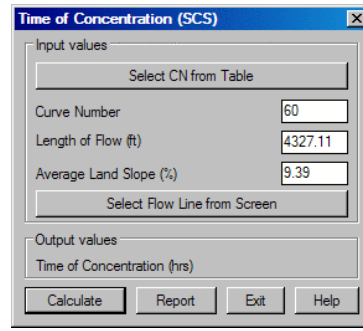


Drainage 2

7 Time of Concentration (Tc). This is a quick step necessary for ultimately getting the Peak Flow. Under Watershed, go to *Time of Concentration (Tc)*. We will use the SCS method, and the window will look as follows. The CN number should have been brought in from the last routine, but we will have to Select Flow Line from Screen. This will allow for picking the flow line from the map. This routine will also be executed twice to calculate the TC for both drainages.

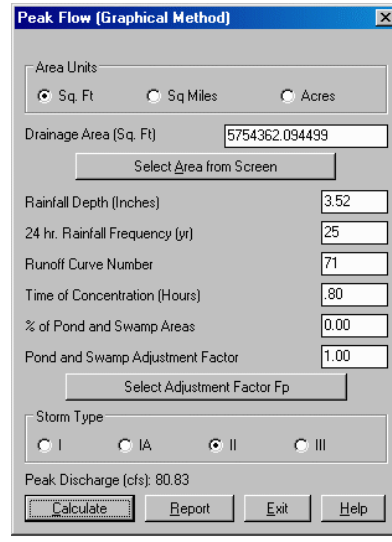


Drainage 1

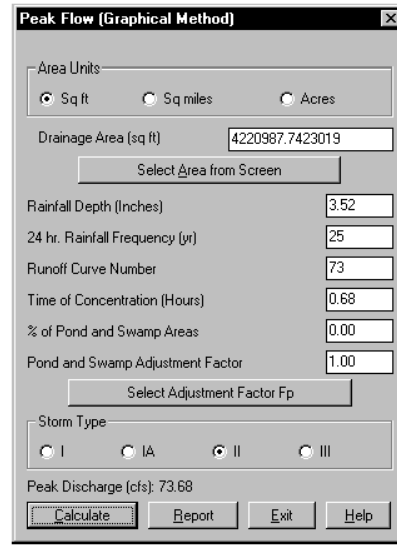


Drainage 2

8 Peak Flow (Graphical Method). Now, let's see what the peak flow will be in each drainage, based on the previous seven steps. The drainage area of the last watershed calculated should appear in the Area window. If not, then simply type it in. The Rainfall depth, frequency, CN, and TC also should be there. All we have to do is hit Calculate, and the peak discharge appears at the bottom in CFS (cubic feet per second). This routine should be run twice, once for each drainage. Notice that all of these routines have a Report button to keep a running log of all the calculated data.

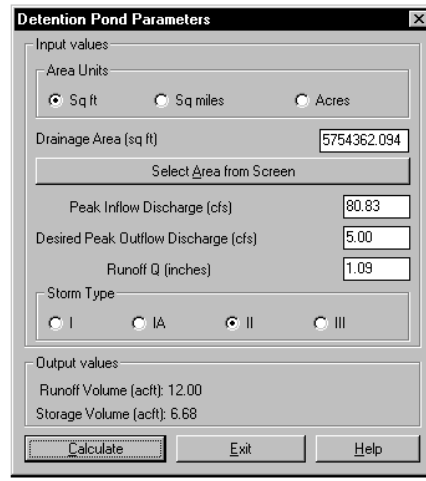


Drainage 1

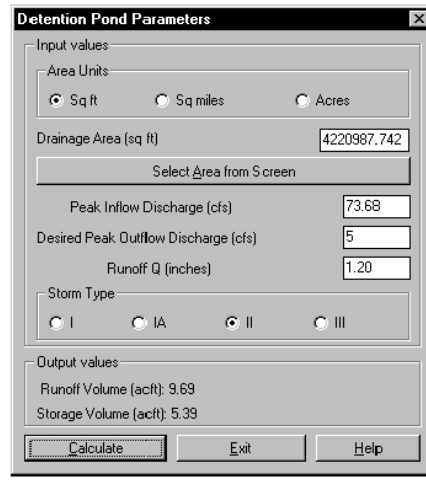


Drainage 2

9 Detention Pond Sizing. Now we need to see how large the ponds need to be to detain this size of a storm event. Under Structure, go to *Detention Pond Sizing*. The Peak Inflow Discharge from the last area calculated will appear, as well as the area. In this example, we will allow for a combined maximum 10 CFS to be discharged from the ponds. This means that 5 cfs from each will be our Desired Peak Outflow. Type that in. Hit Calculate, and the Runoff Volume and the Storage Volume will appear at the bottom of the window. In pond number one, we need to store 6.68 acre feet of water. In pond number two, we will need 5.39 acre feet of storage. So now we have a starting point, and we can now create the pond in 3D with these sizes.



Drainage 1

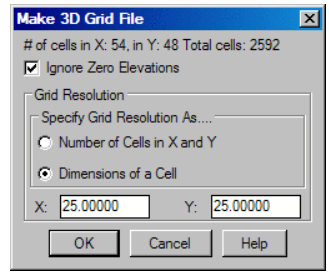


Drainage 2

10 Design Valley Pond. We know approximately where we want the two ponds, and have the dam polylines drawn in the drawing already. They are in the top-of-dam layer. If it is frozen then thaw it out now. We will run *Design Valley Pond,* found under the Structure pulldown menu. For pond number one (corresponding to Drainage 1), the values to enter at each prompt are:

Command: vpond
Source of surface model [File/<Screen>]? *choose Screen*
Pick Lower Left limit of pond disturbed area <541884.0,158364.0>: *Window the area, being*

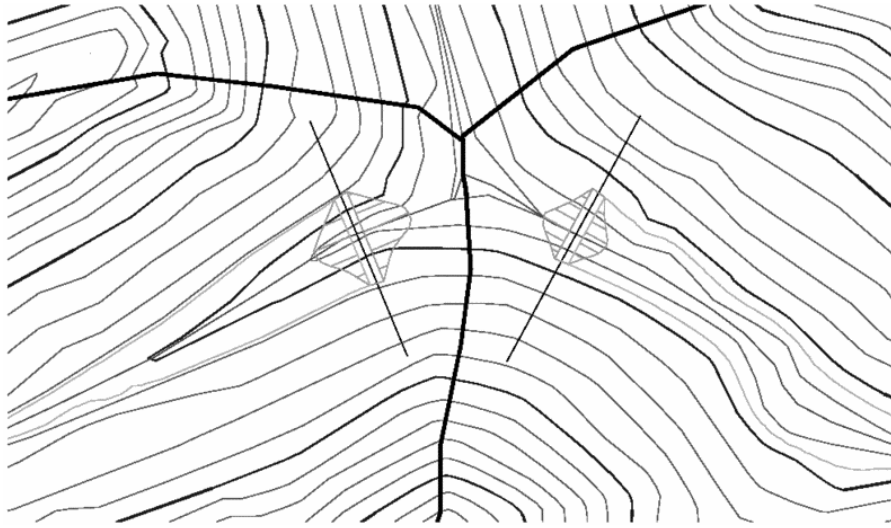
generous to include all the affected surface contours
This dialog box appears. Make the Dimensions of a Cell 25' x 25' and click OK.



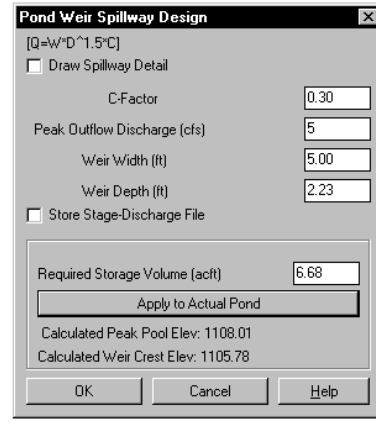
Pick the top of dam polyline: *pick it*
Reading points ... 4754
Pick a point within the pond: *pick a point* upstream from the top of dam polyline
Enter slopes as percent grade or slope ratio [Percent/<Ratio>]? *press Enter*
Enter the outslope ratio <2.0>:2
Enter the interior slope ratio <2.0>: 2
Enter the top of dam width <10.0>: 25
Range of existing elevations along dam top: 1082.10 to 1171.87 (these are what it found)
Enter the top of dam elevation: 1117
Cut pond interior [Yes/<No>]? N
Calculate stage-storage values [<Yes>/No]? Y
Method to specify storage elevations [<Automatic>/Interval/Manual]? I
Starting elevation <1078.16>: 1078
Elevation interval <2.00>:*press Enter*
Output grid file of final pond surface [Yes/<No>]? *press Enter*
A Valley Pond Report is produced. Review it and exit out.

Write stage-storage to SEDCAD file [Yes/<No>]? Y This will be a ∗.CAP file. (Name it pond1.)
Adjust parameters and redesign pond [Yes/<No>]? N
Trim existing contours inside pond perimeter [Yes/<No>]? N
Contour the pond [<Yes>/No]? N

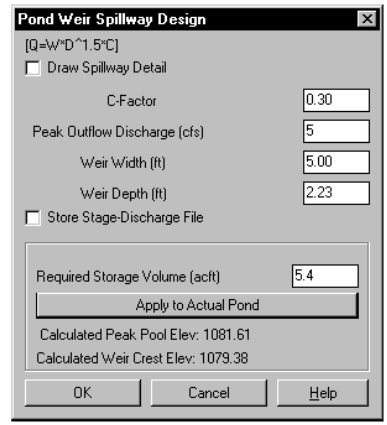
You should now have a pond that looks like the one on the left in the following drawing. Repeat the routine for Pond 2, using a top of dam elevation of 1090, and starting at a low of 1064.



11 Pond Weir Spillway Design. Now let's see what the spillway will need to be for the storage calculated. We will allow 5 CFS of discharge, so what will be the elevations of the spillway. Under Structure, go to *Rectangular Weir Design*. That will bring up the following window:



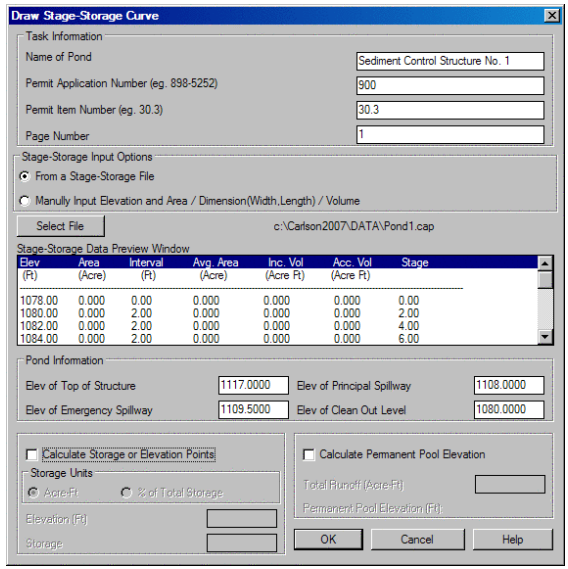
Pond 1



Pond 2

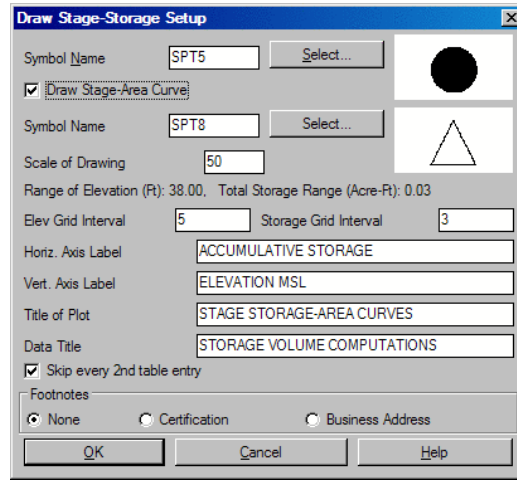
The C-factor we will use is about .3. We will allow up to 5 CFS discharge. This will calculate the depth of the weir (if that is what we use, we'll use a drop pipe in 1, and a channel in 2) with the equation shown at the top of the window. Our required storage volume is 6.68 acre feet for pond one (5.4 for pond two). Hit the Apply to Actual Pond and choose the Pond1.cap file. This should give the two elevations shown in the dialog: 1108.1 for top of pool, and 1105.78 for bottom of spillway. This will be our principle spillway. Our emergency spillway will just be assumed to be 1.5 feet higher.

12 Draw Stage-Storage Curve. Now that we have the spillway elevations and a capacity file (∗.CAP) for each pond, let's draw the Stage Storage/Area Curve Graphs to get a graphic of the curves with values to follow. Under Structure, go to *Stage-Storage*, then slide over to *Draw Stage-Storage Curve*. Below the following dialog box are the settings to be entered for Pond 1:



Pond 1

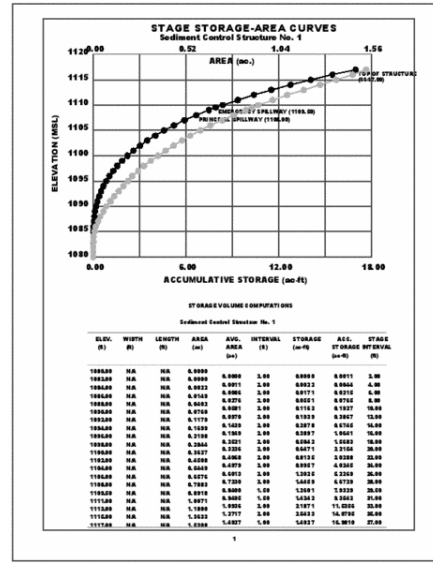
Click OK.



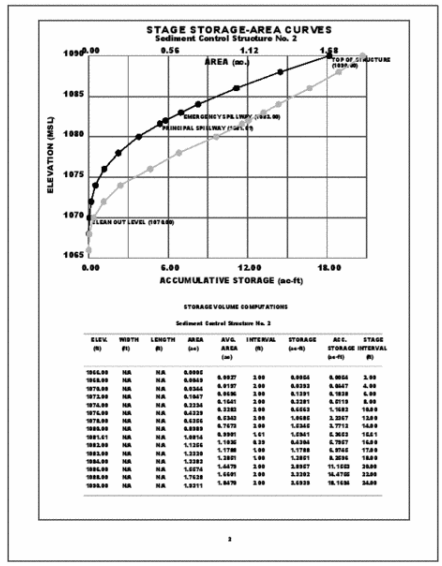
Click OK.

Pick Starting Position: *pick a spot* in the open drawing

Do the same for Pond 2, with the other elevations from the spillway and top of dam calculated above, and choose to put this on Page Number 2. Your graphs should look like the two pictured.

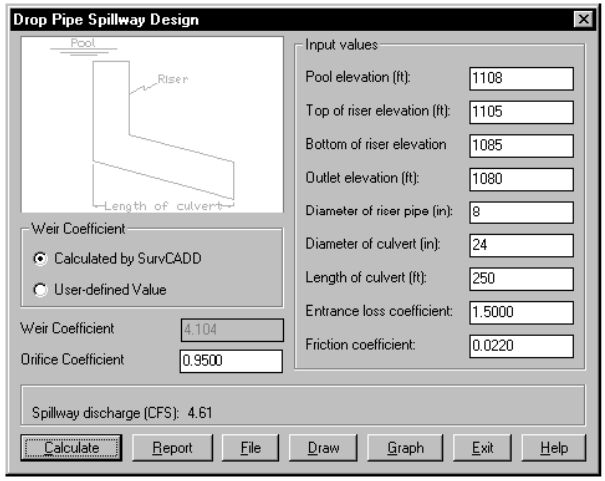


Drainage 1

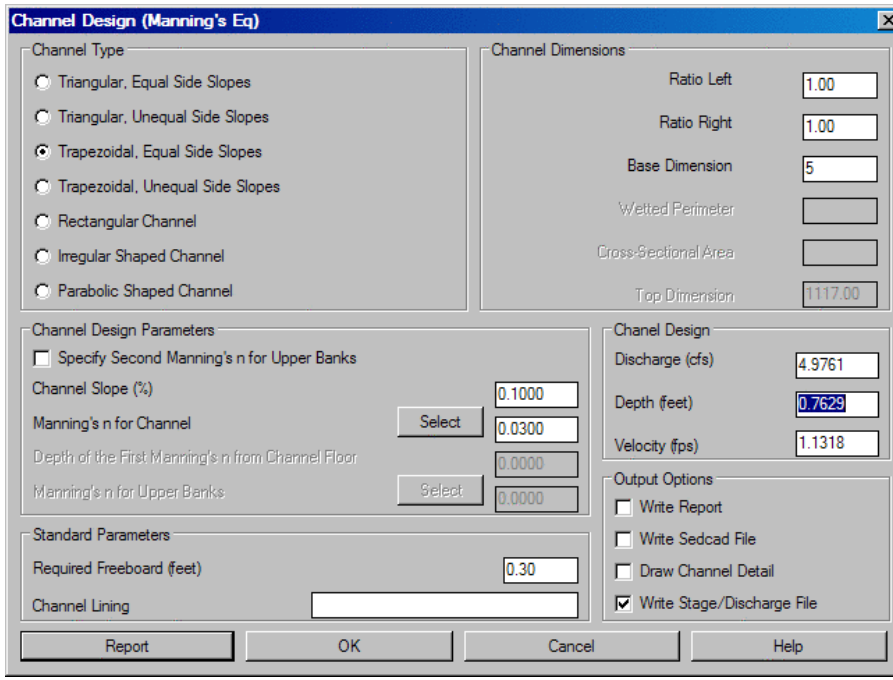


Drainage 2

13 Drop Pipe Spillway Design. This will give us a stage discharge file that we will add to our structure in the routine of the storm through our ponds. We will only do this in pond 1. Pond 2 will have a channel, which will create a different stage discharge file. Go to the Structure pulldown to *Drop Pipe Spillway Design*. We will design one for the flow we need. Enter in the values shown in the window and hit calculate to get near the 5 CFS discharge we are looking for. Hit File to create the discharge file for pond 1.

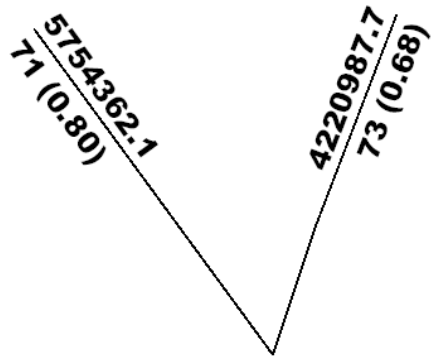


14 Channel Design Manning's n NonErodible. This will generate the other stage discharge file for pond 2. Go to the Structure pulldown to *Channel - NonErodible.* Enter in the parameters shown, and create the second STG file, this one for pond 2. It will calculate the depth and the velocity, base on our dimensions entered.

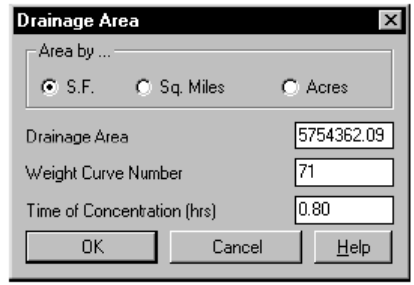


Click OK. You will then provide a file name for the new STG file and save it. It will calculate the depth and the velocity, based on our dimensions entered. Enter a depth of 9 and a base elevation of 1081.61 for the bottom.

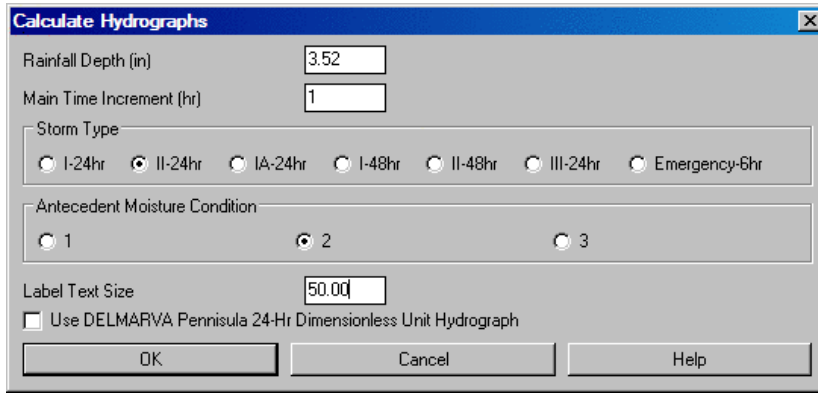
15 Draw Flow Polylines. Now we will look at creating a skeleton structure of our flow lines with these structures place on them. We will first produce a hydrograph of the two drainages without the ponds, then add the ponds to the flow polylines and regenerate the hydrographs. We hope to reduce the discharge to a much smaller amount, but over a longer period of time. Under Watershed, go to *Draw Flow Polylines*. This will let us pick a point, from high to low. As seen in the diagram, pick from NW to SE. Enter in the three parameters for Drainage 1.



When asked to draw another, select yes, and join it with the fire st at the bottom right corner, near the endpoint. This will place the text on them and allow for the next step.

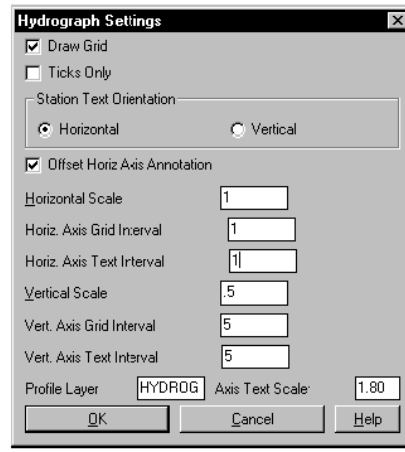


16 Hydrograph Development. This routine will run the TR-20 program and generate a hydrograph file that we can draw on screen. Under Watershed, go to *Hydrograph Development* and select the two Flow Polylines and the text associated with each one.

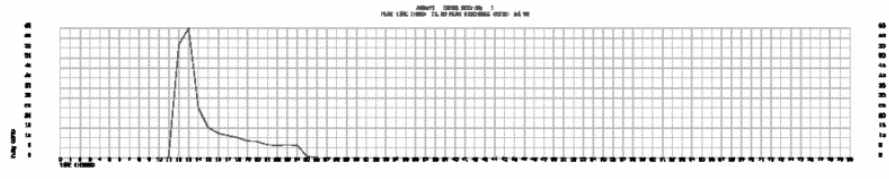


The routine will run the TR-20 and give a Standard Report Viewer report. There are now some hydrograph files created in the data directory that we can draw in the next step.

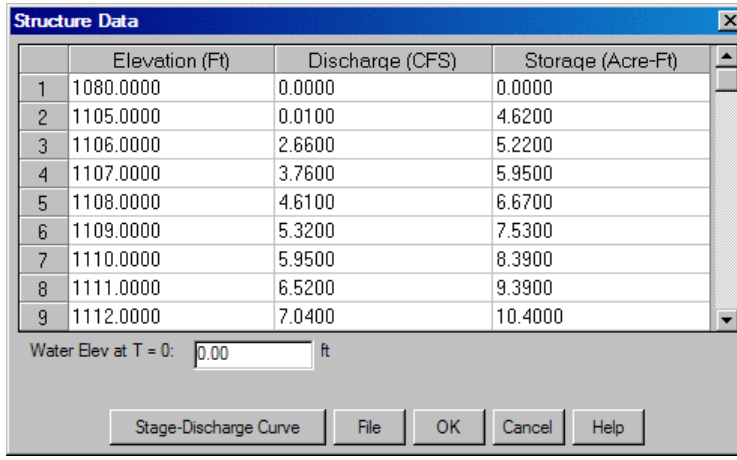
17 Draw Hydrograph. Under the Watershed pulldown, go to *Draw Hydrograph* and select the ADD.h1. This is the file of both drainages combined.



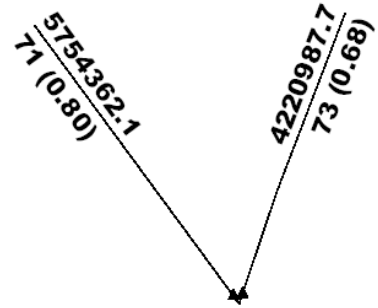
The scales to be used should be about 1,1,1,0.5,5,5 and we will draw the grid on the first one, and turn off grid for additional hydrographs. Choose starting time of 0, and an ending time of 80 (the next one will go that long).



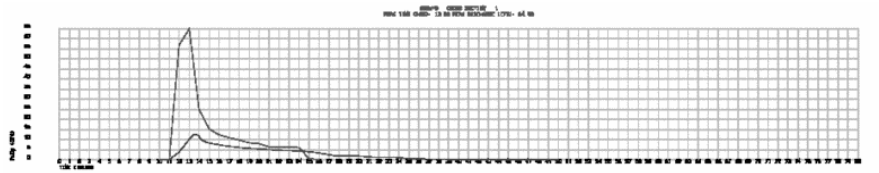
18 Locate Structures. The *Locate Structures* command, located in the Watershed menu, will place a symbol on our flow lines to representing the ponds and spillways. This will create a small triangle at the end of each flow line where they were picked.



Hit the File button twice: once to pick the CAP file, and again to pick the STG file. Finally, after you hit OK, you are now ready to run *Hydrograph Development* again to generate the new hydrographs.



Now, run *Hydrograph Development* again, from the Watershed menu, and select the flow lines, plus the symbols. This will create the new hydrograph as shown below. It has a much smaller peak, but a longer time for the event. It does stay within our maximum outflow parameters.



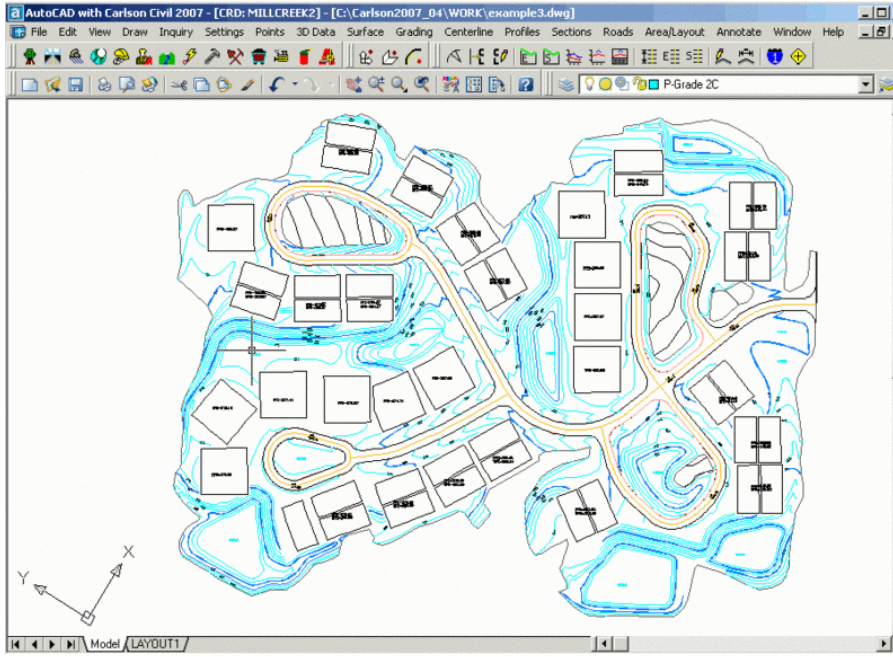
This completes the Lesson 11 tutorial: Hydrology and Watershed Analysis.

Lesson 12: Stormwater Network Design

In this tutorial, we'll layout the structure and pipes for the stormwater drainage and analyze the flow for a portion of a site. We'll use the tools to automatically calculate the drainage and runoff coefficients. These automated methods require setup of a surface and runoff regions. Alternatively, these tools can be skipped in which case the drainage areas and runoff coefficients for the inlets can be entered manually into the sewer network.

Step 1 - Open Drawing

From the File menu, choose Open and select EXAMPLE3.dwg from the Carlson Work folder (ie. C:\Carlson2007\WORK\EXAMPLE3.dwg).

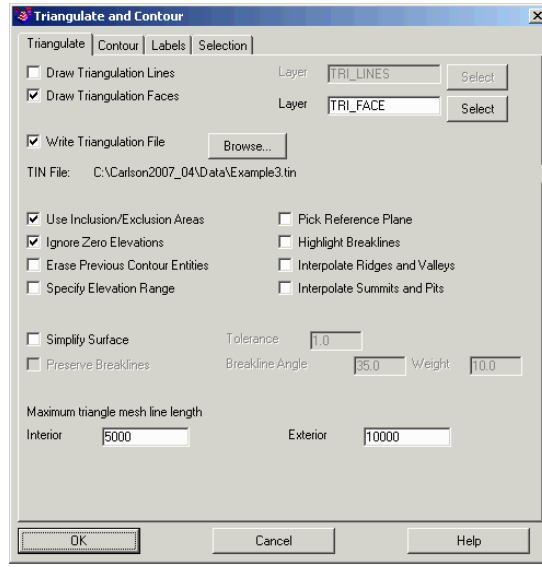

AutoCAD with Carlson Civil 2007 - [CRD: MILLCREEK2] - [C:\Carlson2007_04\WORK\example3.dwg]
File Edit View Draw Inquiry Settings Points 3D Data Surface Grading Centerline Profiles Sections Roads Area/Layout Annotate Window Help
P-Grade 2C
X
Y
Model
LAYOUT1

Step 2 - Make Surface Model

The drawing entities for the design surface that we will use to model drainage have already been prepared. These entities consist of design contours, elevated pad perimeter polylines, spot elevations and 3D polylines for the road centerlines and face of curbs.

To model the drainage, the program can use either triangulation or grid surfaces. For this example, triangulation is used so that the flow can follow the edges of the road. In general, triangulation is needed for surfaces with breaklines and grids are useful for surfaces defined by contours alone.

Run the Triangulate & Contour command from the Surface menu. In the dialog, go to the Contour tab and turn off Draw Contours. Then in the Triangulate tab, turn on Draw Triangulation Faces, Write Triangulation File, Use Inclusion/Exclusion Areas and Ignore Zero Elevations. Pick the Browse button, choose a faster and more efficient TIN format, and set the file name as Example3.tin. Then pick OK.

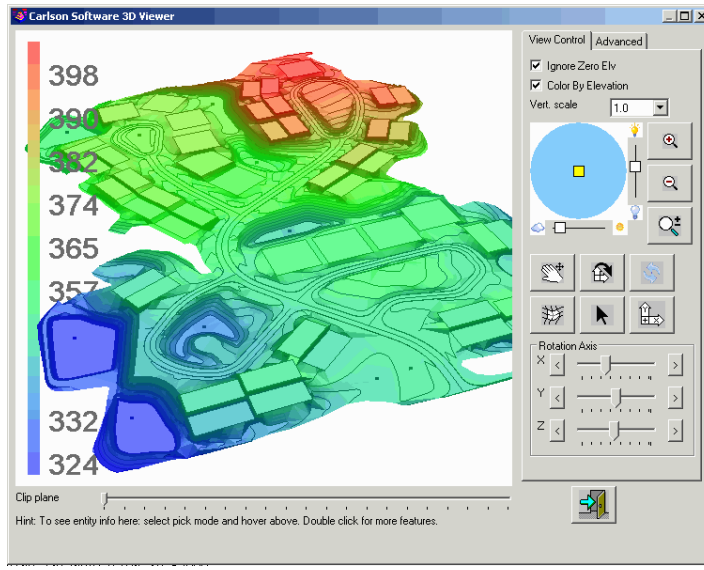


At the command line, the program will prompt for the inclusion and exclusion perimeters. Pick the perimeter polyline for the inclusion and nothing for exclusion. Next, for the select objects to triangulate, enter All and press Enter.

Select the Inclusion perimeter polylines or ENTER for none.
Select objects: *pick the perimeter polyline*
Select objects: *press Enter*
Select the Exclusion perimeter polylines or ENTER for none.
Select objects: *press Enter*
Select the points and breaklines to Triangulate.
Select objects: *All*
Select objects: *press Enter*
Reading points... 11149
Inserted 11149 points
Inserted 10896 breakline segments
Writing Triangulation File: C:\carlson2007_04\data\example3.tin
Drawing Triangulation 3D Faces ...
Step 3 - Check Surface

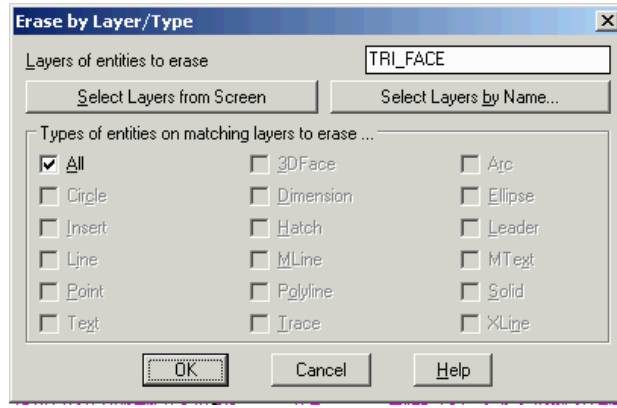
This step is optional to verify that the surface is good by checking for bad elevation data points and that the surface follows the data points.

With the triangulation drawn as 3D Faces, run the 3D Viewer Window command in the View menu. At the command line, it will prompt to select the objects to view. Enter All and press Enter.
Select all entities for the scene.
Select objects: *All*
Select objects: *press Enter*



In the 3D Viewer dialog, move the pointer near the center of the graphic and the cursor will change to a X/Y symbol which is the X/Y axis rotation mode. Click down the left mouse button and drag down to rotate the site to a good viewing angle. Then move the pointer near the edge of the graphic and the cursor will change to a Z symbol which is the Z axis rotation mode. Click down the left mouse button and drag around to rotate the pile. To fill in the triangulation faces, pick the Shade icon. You can also choose the Color By Elevation toggle for better viewing of the elevation range.

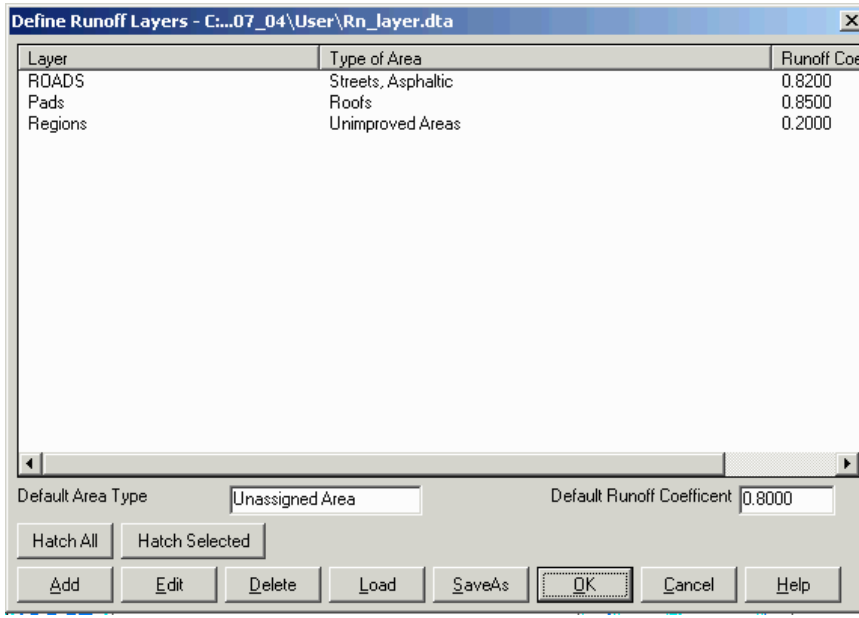
The surface looks right in the 3D Viewer. The site has a slope from the top road circle down towards the detention ponds at the bottom. Close the 3D Viewer by choosing the Exit Door button. We don't need the 3D Faces anymore. Let's delete them by running Erase By Layer in the Edit menu. Choose the Select Layers From Screen and pick any 3D Face. Then pick the OK button.



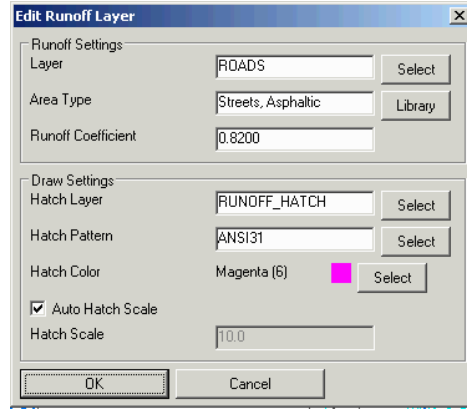
Step 4 - Runoff Coefficients

This step sets up layers that are assigned Rational Method runoff coefficients and applied to closed polylines on the specified layers. The runoff coefficients are the C-Factors in the Rational Equation Q = C∗I∗A. Q is flow, I is rainfall intensity and A is area. The runoff polyline areas use region logic where a polyline inside another on the same layer is used as an exclusion. A limitation is that polylines on the same layer must not intersect each other. For polylines on different layers, there can be polylines within other polylines and for any given point, the smallest enclosing polyline is used to determine the runoff coefficient.

In this example, the site perimeter polyline is on the Regions layer, the building pads are on the Pads layer and the edge of pavement polylines are on the Roads layer. All these polylines are already closed polylines. So we're ready to assign the runoff coefficients to the layers. Run Define Runoff Layers in the Watershed menu. Begin with an empty dialog by deleting any existing layers in the table. Select the Add button.

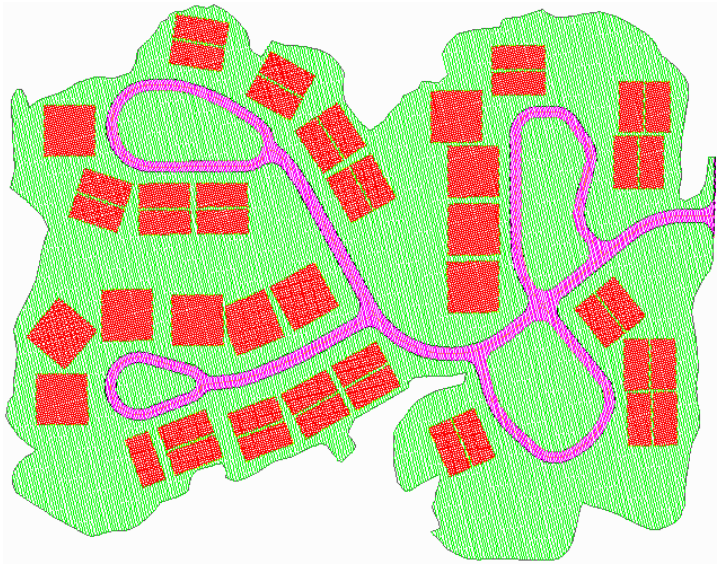


Let's add the road layer first. Use the Select button next to the Layer field and select the layer name ROADS from the list or screen pick a road polyline. Next choose the Library button and select Streets, Asphaltic from the list. Under the Draw Settings, set the Hatch Color to Magenta. When the dialog is set as shown, pick OK.



Repeat the Add function for the Pads layer and set the runoff to Roofs and the color to Red. And repeat add for the Regions layer and set the runoff to Unimproved Areas and the color to Green.

From the main dialog, pick the Hatch All which gives a visual check of the runoff coefficient areas. The areas within the buildings are inside both the Region and Pads polylines and the Pads govern because they are the smaller area. Likewise the road areas are governed by the Roads layer and road interior islands are not counted for Roads because the interior Roads polyline acts as an exclusion perimeter. The rest of the area is set to the Regions layer.



With the three layers defined, click OK from the main dialog.

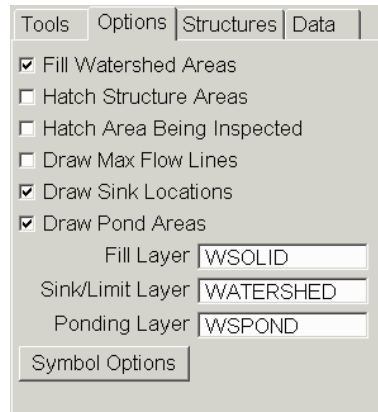
We don't need to keep the runoff hatches. Let's delete them by running Erase By Layer in the Edit menu. Choose the Select Layers From Screen and pick any hatch to get the RUNOFF_HATCH layer. Then pick the OK button.

Step 5 - Watershed Analysis

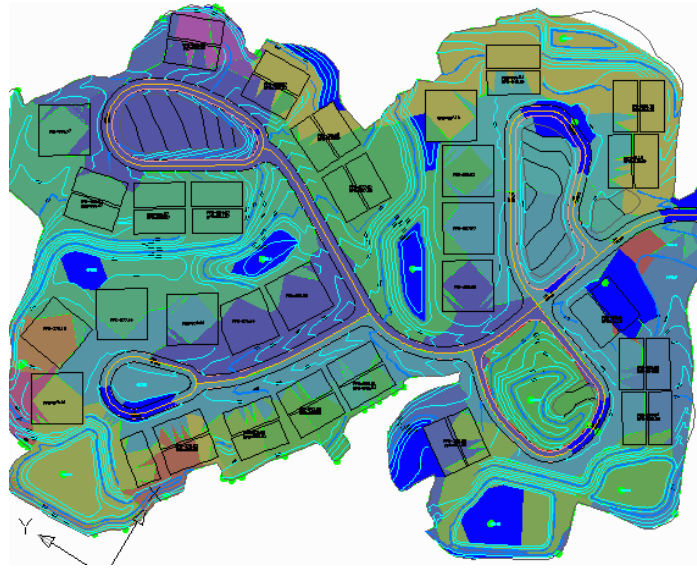
From the Watershed menu, pick Watershed Analysis and when prompted for the surface file, choose Example3.tin. The program dialog docks on the left side of the drawing.

Before processing the watersheds, set the Rainfall to 1 inch. The program uses the runoff volume calculated from the rainfall depth and drainage areas to figure when the runoff is enough for the flow to go through a low point. If the rainfall depth is set to zero, then the flow lines will stop at every low point or dimple in the surface. At this point, we have not defined our storm event to know the actual rainfall depth. If we did get the storm rainfall depth, we could enter it. For now we're just using Watershed Analysis to give a general idea of the watershed areas and runoff flow lines.

The next step is to pick the Process button and the program calculates the flow connections between each triangle. Once the surface is processed, we can run any of the analysis tools. First, go to the Options tab and turn on Fill Watershed Areas, Draw Sink Locations and Draw Pond Areas.

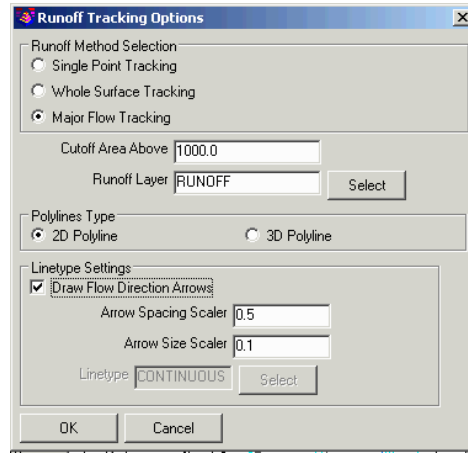


Go back to the Tools tab and pick the Draw Watershed Areas button. Each watershed area is drawn with a closed polyline and solid filled with different colors. Also, for each watershed the sink (lowest point) is drawn with a solid circle symbol. The areas covered by ponding are drawn as solid blue hatches. The depth and size of the pond areas is determined by the runoff volume. In many places, the pond areas are inside the detention pond structures. In a few places, the ponds are at low points in the road which indicate areas that we need to add storm sewer inlets.

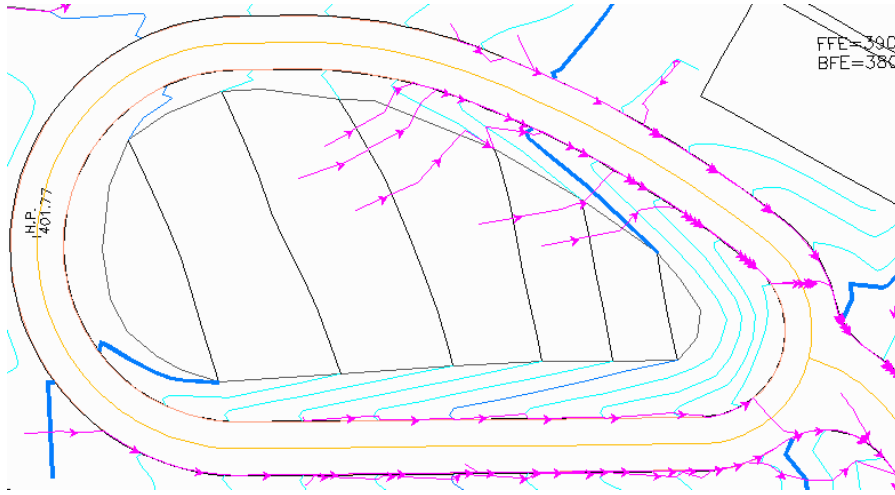


To navigate around the watershed display, move the pointer into the graphic view and use the middle button of the wheel mouse, if you have one, to pan and zoom. If you don't have a wheel mouse, then use the top toolbar icons of the Watershed Analysis dialog to zoom and pan. When you are done inspecting the watersheds, pick the back arrow next to the Draw Watershed Areas button to erase all the watershed entities.

Next, choose the Runoff Tracking button. In the options dialog, choose Major Flow Tracking that draws flow lines only when the drainage area for the flow line is greater than the specified area. Then choose the 2D Polyline type and the Draw Flow Direction Arrow to use a flow linetype with arrows showing the flow direction.

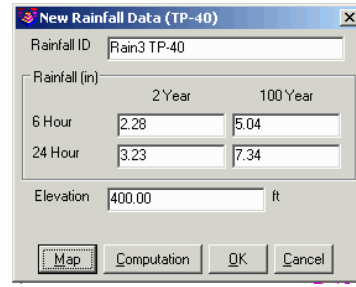


Use the zoom and pan methods to inspect the runoff flow lines. This graphic shows the flow lines coming off the road circle at the top of the site and following the curbs. We're going to leave the runoff flow lines on the drawing to help guide the placement of inlets. Click Exit to end Watershed Analysis.

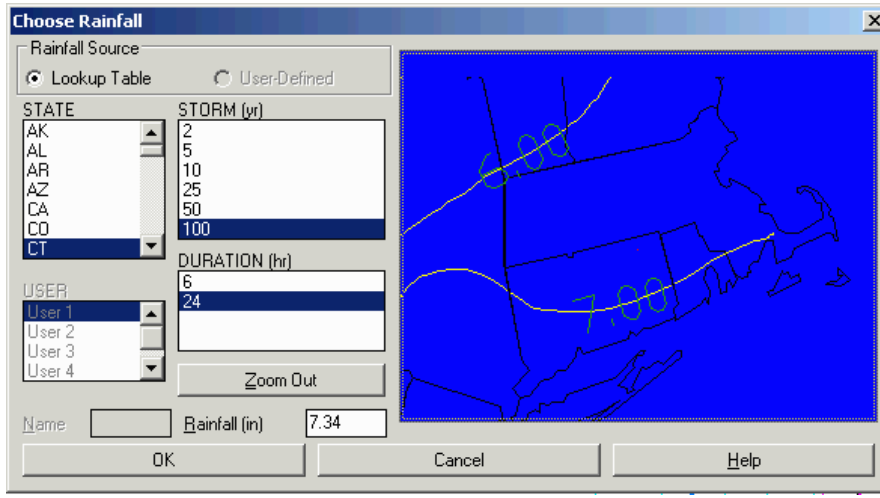


Step 6 - Rainfall

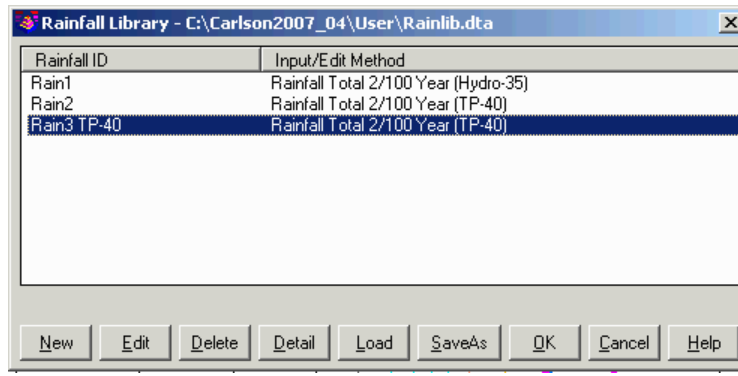
To setup the storm event to apply with this site, run Rainfall Library under the Sewer Network Libraries flyout in the Network menu. This command keeps a list of different storm events that you can use for different locations and requirements. Let's add a storm by picking the New button. There are five types of rainfall definitions. For this example, select the Rainfall Total (TP-40) method. In the New Rainfall dialog for the TP-40 method, fill in a name for the Rainfall ID, the rainfall amounts for the 2 and 100 year storms for 6 and 24 hours, and the average elevation for the site.



You can use the Map button to show the TP-40 rainfall maps for the different storms. And if you pick on the map display, the program will interpolate the rainfall from the maps. In this case, south central CT was picked.



Click OK on the New Rainfall dialog and then pick OK on the Rainfall Library dialog to save the changes.



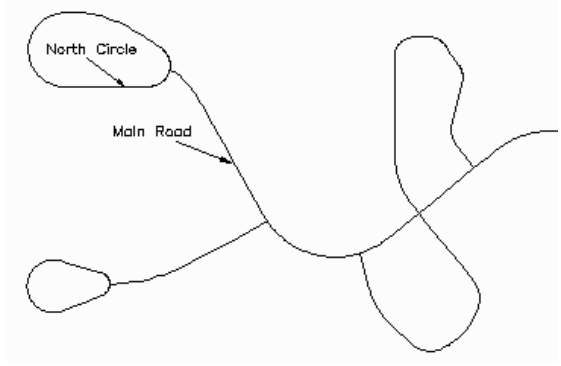
Step 7 - Set Centerlines

In preparation to align the inlet symbols with the road centerlines, we need to create centerline

files (.cl) for the roads. From the Centerline menu of the Civil Design or Survey modules, choose Polyline To Centerline File. In the file selection dialog, enter a name of North.cl. Then enter a starting station of 0, pick the road centerline for the loop road at the top of the site and press Enter at the end of the station list.

Beginning Station <0+00>: *press Enter*
Polyline should have been drawn in direction of increasing stations.
Select polyline that represents centerline: *pick the north loop road centerline*
3dPoly Selected
Station: 0.00 Elevation: 396.832
...
Station: 650.78 Elevation: 396.832
Press ENTER to continue. *press Enter*

Repeat Polyline To Centerline File. For the file name, enter Main.cl. Enter a starting station of 0 and pick the main road centerline.



Step 8 - Set Sewer Network Files

The storm sewer network structures and pipes are stored in a .SEW file. Once the a .SEW file is set as current, the program will continue to automatically use that file. To start a new sewer network, run Set Sewer File under the Sewer Network Setup flyout of the Network menu. In the file selection dialog, choose the New tab and enter a file name of Example3.sew.

The sewer network also works with a current surface model that is used for the default rim elevations, reporting pipe cover and calculating inlet drainage areas. To set the current surface, run the Set Surface File under the Sewer Network Setup flyout of the Network menu. In the file selection dialog, choose our Example3.tin file.

Step 9 - Create Sewer Network Layout

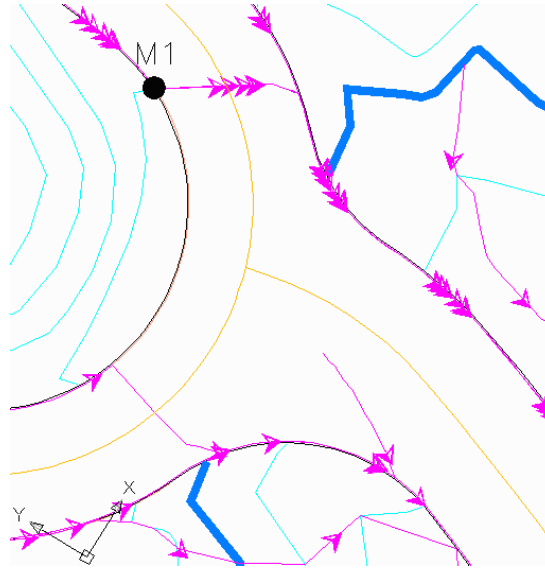
Before starting the layout, set the object snap (osnap) to nearest (nea) to use for locating the inlets along the curb polylines. Under the Settings menu, run Aperature-Object Snap and turn on only the Nearest snap mode.

Now we're ready to layout the inlets and pipes. Let's work on the drainage for the roads of the north loop and the main road and run this flow to an outlet in the central pond.

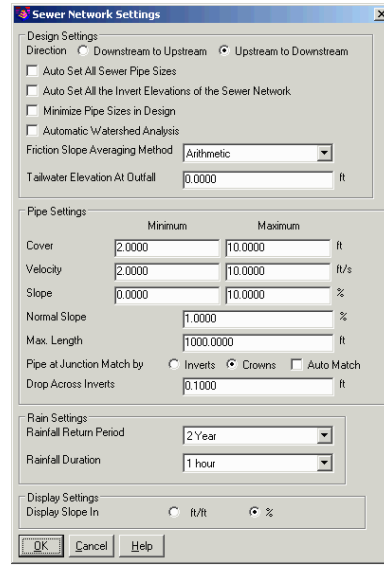
Run Create Sewer Structure from the Network menu. The first prompt is to select from three methods to locate the inlets. Press Enter to choose the default method of screen pick. Next the inlet location is picked. Decide where to put the inlet. You can look at the runoff flow lines and place the inlet to capture these flows. When you have a place for the inlet, zoom in very close so that you can see the curb line.

NOTE: Be sure to pick the bottom, inside curb polyline and not the top of curb. Otherwise, the routine to find the drainage area from the surface model will not capture flow along the curb.

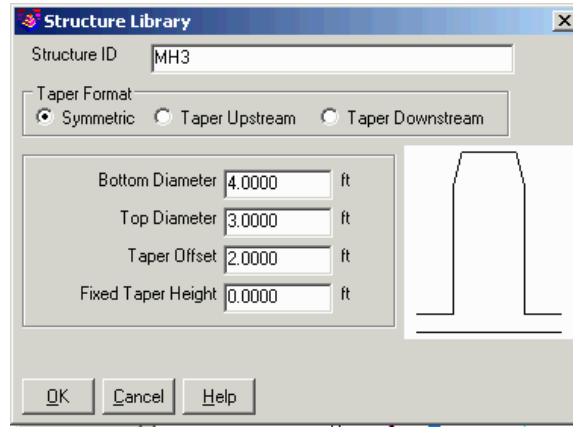
If you have a wheel-mouse, use the wheel to do the zoom in. Otherwise you can use the zoom toolbar or type 'z at the command prompt. After zooming in, pick a point along the curb polyline using the nearest snap to get right on the polyline. In this case, the first inlet will be on the inside curb of the north loop near the intersection as shown with the M1 symbol.



After this first inlet location is picked, the sewer network dialog is docked on the left side of the drawing. Before designing this inlet, pick the Rainfall Library button and select our Rain3. Next choose the Settings button and set the Direction as Upstream To Downstream and set the Display Slope In to %. The Pipe Settings allow you to configure your design parameters. Change the Minimum Cover to 2.0, Minimum Velocity to 2.0, and the Drop Across Inverts to 0.1. Let's go with defaults for the rest. Pick the OK button.



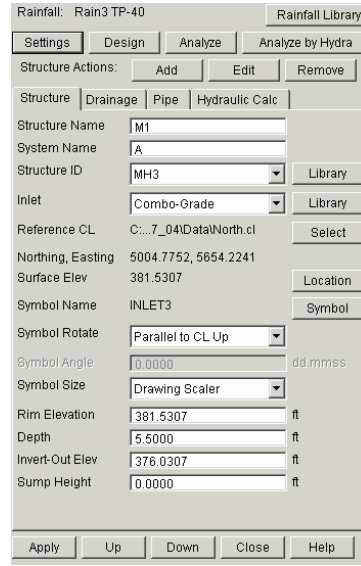
Now let's work on the structure settings. Pick the Library button next to the Structure ID field. This function brings up a list of the available structures as defined in the library. There are three types of structures: box, circular and outfall. You can add your own structures to the library. For this example, use MH3. To check the dimensions for this structure, pick the Edit button. These dimensions are used for hydraulic calculations as well as drawing the structure in the profile and 3D views. Click OK from the Edit dialog and then highlight MH3 from the library list and pick OK.



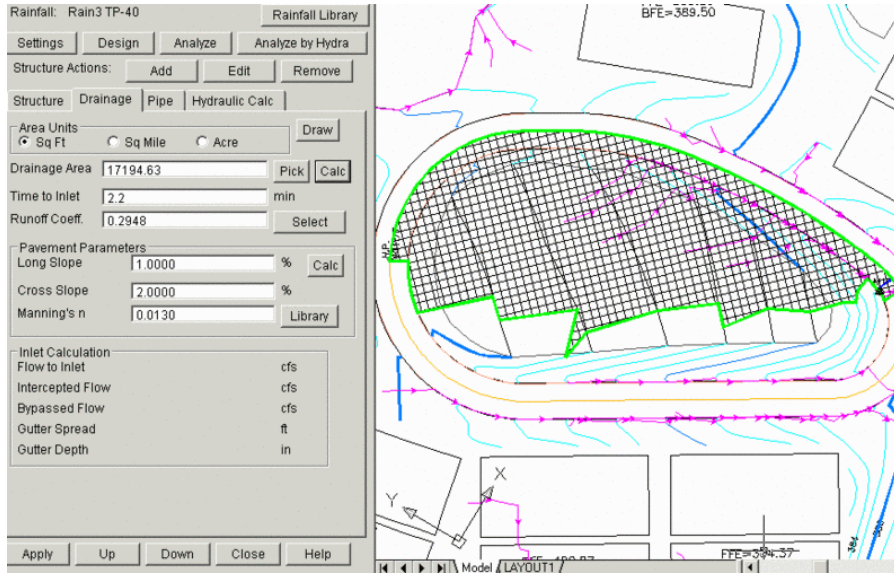
Next, pick the Library button next to the Inlet field. This function shows the inlets defined in the inlet library. There are four types of inlets: slotted, curb, grate and curb/grate combo. Inlets can also be defined as located on-grade along the road or at a sag location. Like the structure library, you can add to and edit the inlet library. For this inlet, choose the Combo-Grade from the list and pick OK.

Next, pick the Select button next to the Reference CL label and select North.cl for the centerline. This centerline can be used to align the inlet symbol. In the Symbol Rotate field, choose Parallel To CL Up.

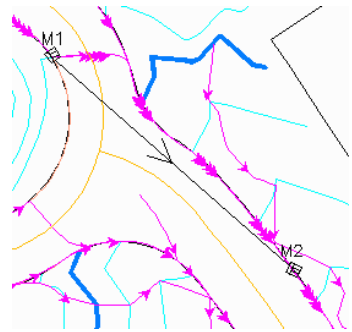
The last change for the structure tab is to set the Depth to 5.5. After making these changes, your dialog should match the settings as shown. Pick the Apply button to save the changes and you should see the plan view symbol for the inlet change to a grate symbol.



Now move onto the Drainage tab. Here the drainage area, time of concentration, runoff coefficient and pavement parameters are set for the inlet. You can manually enter in or have the program calculate these values. With the Pick button, you can select a drainage polyline perimeter and the program will calculate the area and the weighted average runoff coefficient from the runoff layers if defined. In this example, use the Calc button to calculate all the parameters from the surface model. The first time that Calc is called, the program takes time to calculate the triangulation flows. Then the values are filled in and the drainage area is hatched in plan view. The Time To Inlet comes from the max flow line within the drainage area and accounts for the surface slopes along the path. The Runoff Coefficient is calculated as the weighted average of the runoff subareas within the drainage using the runoff layers that we defined in the Define Runoff Layers command. Notice how the drainage area for M1 starts from the road high point and follows the crown of the road to the inlet. In the Pavement Parameters section, the Calc button will calculate the Pavement slopes from the surface aligned by the reference CL at the inlet location.

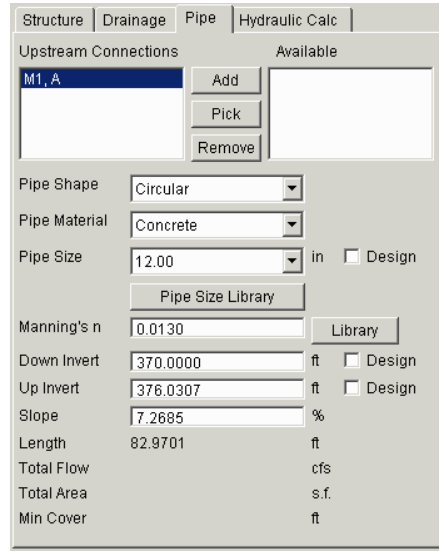


We're done for now with this first inlet. To add the next inlet, pick the Add button from the Structure Actions row. Pick a position along the right side curb polyline of the main road near the intersection as shown here (M2). Again, you may need to zoom in to be sure to snap onto the curb polyline.

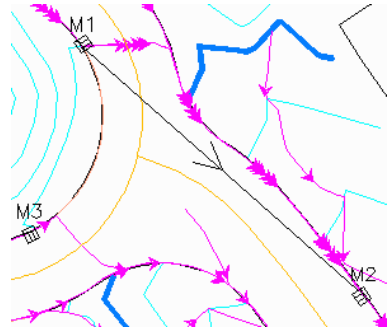


Go to the Structure tab for M2 and change the Reference CL to Main.cl. Then go to the Drainage

tab and pick Calc which fills out all the drainage values. Next select the Pipe tab. The program lists all the used and available structures for a pipe connection to the current structure. By default, a connection is made to the nearest structure as long as it's within the maximum pipe length as defined under Settings. In the dialog, set the Down Invert to 370.1. Switch back to the Structure tab and set the Invert-Out as 370.0.

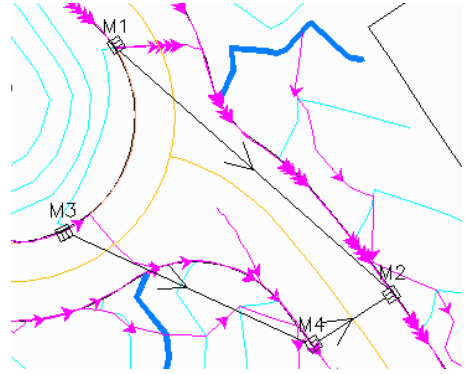


To add the next inlet, pick the Add button. Then pick a position along the inside North loop curb polyline to the left of the intersection as shown here (M3).



A pipe is automatically connected to the nearest structure M1. For this network, we're going to start new branch with M3. So go to the Pipe tab highlight the Upstream Connection list for M1 and pick the Remove button. On the Structure tab for M3, set the depth to 5.5. On the Drainage tab, pick Calc.

Now we're ready for the next inlet. Pick the Add button in the Structure Actions row and screen pick the position along the main road across from M2 as shown here (M4).

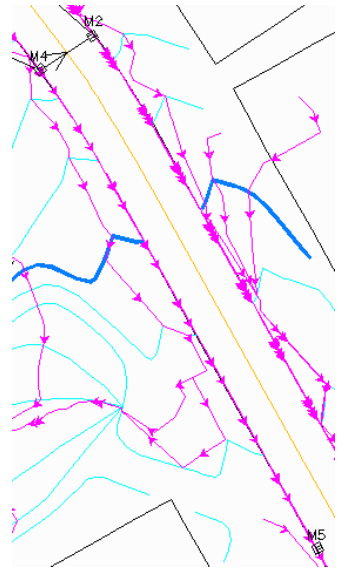


This inlet is on the other side of the road and ths symbol is rotated the wrong way. To fix this, go to the Structure tab and change the Symbol Rotate to Parallel To CL Down and pick Apply to update the drawing. Also, change the Invert-Out to 371. Next go to the Drainage tab and pick

the Calc button. Again the pipe connection defaulted to the nearest structure of M2. Instead we want the connections to go from M3 to M4 to M2. Under the Pipe tab, highlight the Upstream Connection for M2 and pick Remove. Then highlight the Available structure of M3 and pick Add. For the pipe parameters, change the Down Invert to 371.1. Then go back to the Structure tab and set the Invert-Out to 371.0.

To create the pipe from M4 to M2, pick the Edit button in the Structure Actions row. Then pick on the M2 label or symbol to edit M2. From the Pipe tab, highlight M4 from the Available list and pick Add.

Now let's add the next inlet. Pick the Add button in the Structure Actions row and pick a position further down the main road from M4 as shown here (M5).

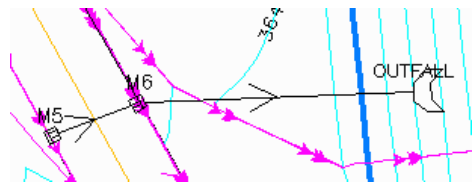


Under the Structure tab, change the Depth to 4.5 and set Symbol Rotate to Parallel To CL Down. Under the Drainage tab, pick Calc. Again we want to remove the default pipe connection since M5 will be the start of a new branch. Go to the Pipe tab, highlight the M4 connection and pick Remove.

We have one more inlet to add. Pick the Add button and pick along the curb on the other side of the main road from M5. See M6 in the graphic here.

Under the Structure tab, set the Symbol Rotate to Parallal To CL Up to flip the symbol around. Under the Drainage tab, pick Calc. Under the pipe tab, add a connection to M2.

For the last structure, pick the Add button and pick on the 356 contour in the pond to the right of M6.



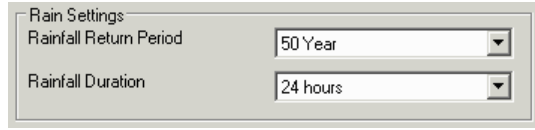
In the Structure tab, change the Structure Name to Outfall, set the Structure ID to Outfall-Wall1 and change the Depth to 4.0. In the Pipe tab, set the Down Invert to 352.0.

The initial sewer network layout is done. Pick the Close button and if prompted whether to Save Change, choose Yes.

Step 10 - Flow Analysis

The network flow can be analyzed in the Edit Sewer Structure and SpreadSheet Sewer Editor commands. For this example, we'll use Edit Sewer Structure. Either choose this command from

the Network menu or double-click on any sewer network label. The same docked dialog from Create Sewer Structure is used. Under the Settings button, choose Period of 50 Year and Duration of 24 Hours. Then pick OK to exit Settings.



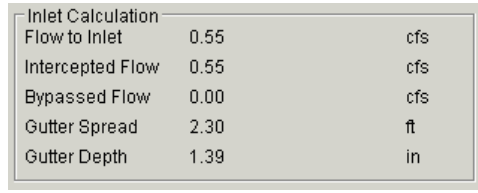
Next, pick the Analyze button which runs the selected storm event through the system. If any of our design parameters are exceeded as specified under Settings, the program displays a report. Here's the report for our first Analysis run.

Process Warnings for Sewer Network A
1: The pipe slope from OUTFALL to M6 is greater than 0.1000 ft/ft.
2: The average pipe flow velocity from M6 to M5 is less than 2.0000 ft/s.
3: The average pipe flow velocity from OUTFALL to M6 is greater than 10.0000 ft/s.

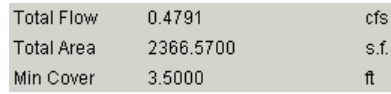
Let's take care of warning #1 for the pipe slope. Choose the Edit button on the Structure Actions row and pick the Outfall label or symbol to edit the Outfall structure. To reduce the pipe slope from M6 to Outfall while keeping the upstream pipe slopes, we will create a step-up at M6. Go to the Pipe tab and change the Up Invert to 356.0. This changes the Invert-Out at M6 while holding the Invert-Ins at M6.

Pick the Analyze button again. The warning report should only have the flow velocity warnings if any. Exit the report if it comes up. The flow velocity warnings can be resolved by resizing pipes and setting inverts which we will do later. Now let's review the flow results from the dialog.

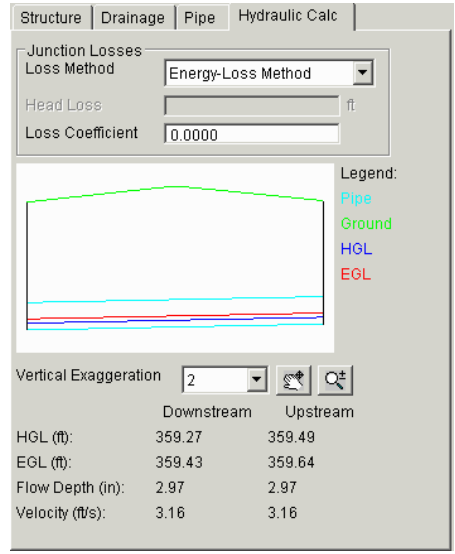
From the Outfall structure, pick the Up button to move up to M6. From the Drainage tab, the flow results are displayed in the Inlet Calculation section. The Flow To Inlet is calculated by the Rational Method using the Drainage Area, Time Of Concentration and Runoff Coefficient for this inlet. The Intercepted Flow, Bypassed Flow, Gutter Spread and Gutter Depth are calculated from the inlet dimensions using formulas from HEC-22. These values can be used to determine whether you have the right inlet structure to capture the flow.



Switch to the Pipe tab. The flow, area and cover are displayed for the pipe connection currently highlighted from the Upstream Connections list. The Total Flow is the accumulated flow for the current pipe. The Total Area reports the accumulated drainage areas for all the inlets coming into this pipe. The Min Cover is calculated using the surface model to the top of the pipe.



Switch to the Hydraulic Calc tab which shows a graphic of the pipe structure, ground surface, hydraulic grade line (HGL) and energy grade line (EGL), along with the HGL and EGL elevations, Flow Depth and Flow Velocity at the pipe upstream and downstream connections.



You can go to other structures to check the flow values for them or use the Report Sewer Network to review the values in a report view. For our storm event, many of the pipes can be resized. For example, the 12" pipe from M5 to M6 has only 3" flow depth. To resize the pipes, you can go to the Pipe tab and change the Pipe Size. The program can also automatically size the pipes based on the flow. To size specific pipes, go to the Pipe tab and pick on the Design toggle next to the Pipe Size field. Then run pick the Design button at the top of the dialog and the program will run a flow analysis and set the pipe size for these pipes marked for Design. To have the program size all the pipes, choose Auto Set All Pipe Sizes in the Settings dialog and then pick the Design button.

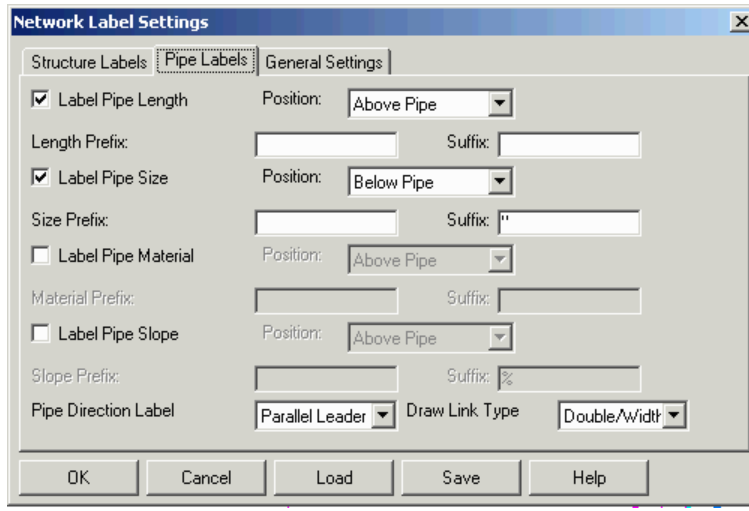
For this example, let's have the program assign all the pipe sizes. Pick the Settings button. Turn on Auto Set All Pipe Sizes and Minimize Pipe Size In Design. Then pick OK. The pipes are resized to match the flow. Pick on the Pipe and Hydraulic tabs to see the changes. A few of the upstream pipes are set at 6" and 9", and the rest are 12". The different pipe sizes that the program uses are defined in the Pipe Size Library.

After the pipe sizing, there are a couple flow velocity warnings. To lower the velocity for the M2 to M6 pipe, pick the Structure Action button for Edit and pick M6. Then go to the Pipe tab and highlight M2 from the Upstream Connections list. To make a step-up of 2 feet, set the Up Invert to 368.0. Next, to lower the velocity from M6 to Outfall, pick the Down button to move to the Outfall structure. From Pipe tab, change the Up invert to 354.5.

Now run Analyze function which should now complete without any warnings. Pick the Apply button to save the results and then pick Close.

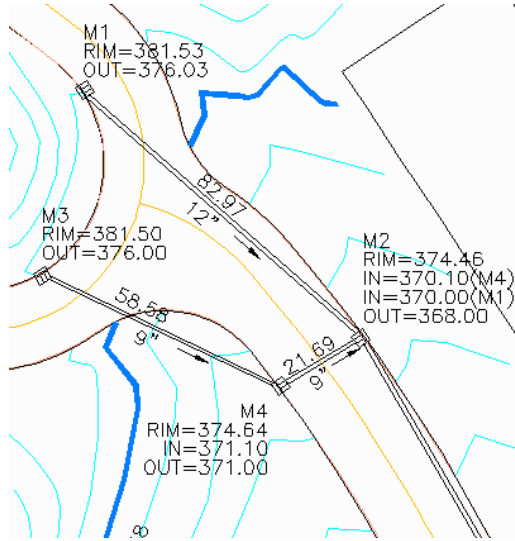
Step 11 - Plan View Labels

At this point, the sewer network labels are only showing the inlet name and pipe direction arrow. To change the label format, run Plan View Label Settings in the Sewer Network Setup flyout of the Network menu. In the settings dialog, under the Structure Labels tab turn on Label Structure Name, Label Rim Elevation, Label Invert-In and Label Invert-Out. Under the Pipe Labels tab, turn on Label Pipe Length and Label Pipe Size. For Label Pipe Size, set the Position as Below Pipe. Also set Pipe Direction Label to Parallel Leader and Draw Link Type to Double/Width.



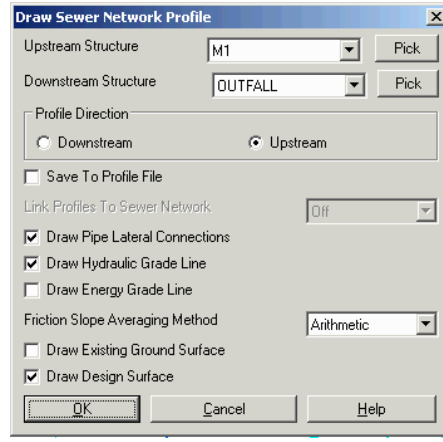
The sewer labels are linked to the sewer network definition so that any changes to the sewer network updates the labels. If you want to explicitly update the sewer labels, run the Draw Sewer Network > Plan View command.

When sewer labels overlap other drawing entities, you can use the Move Sewer Labels command. Let's run this command and move the M4 label to the left of the inlet.

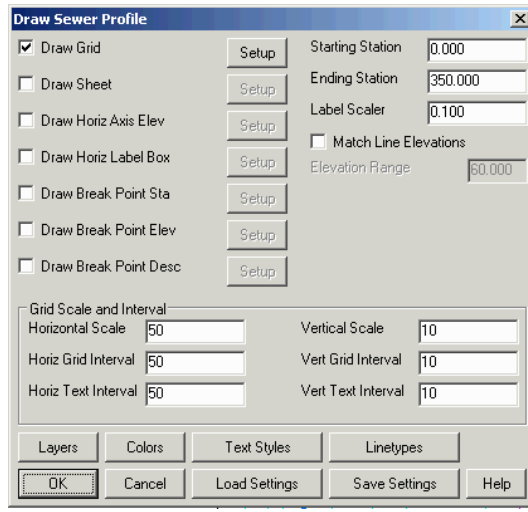


Step 12 - Draw Sewer Profile

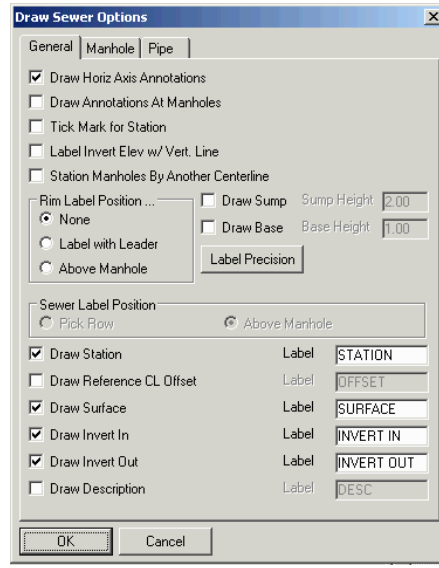
To create a profile for the sewer network, run the Draw Sewer Network > Profile command from the Network menu. In the options dialog, set the upstream structure to M1 and the downstream to Outfall. Also turn on Draw Pipe Lateral Connections, Draw Hydraulic Grade Line and Draw Design Surface. When the setting match the dialog shown here, pick OK.



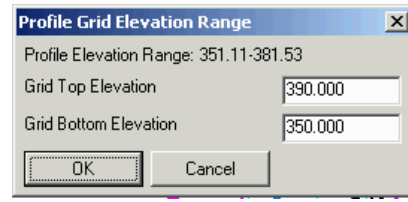
Next, select Example3.tin for the Design Surface File To Read file selection dialog. Then the Draw Profile program is started. In the Draw Profile dialog, set the Vertical Scale and Intervals to 10. Then pick OK.



The next dialog has a lot of annotation settings for the sewer profile. Let's use the defaults for now and pick OK.



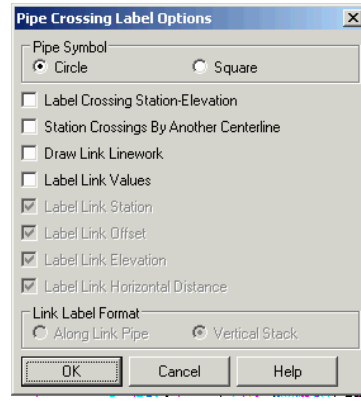
The next dialog prompts for the elevation range for the profile. The elevations default to fit the profile. So just pick OK.

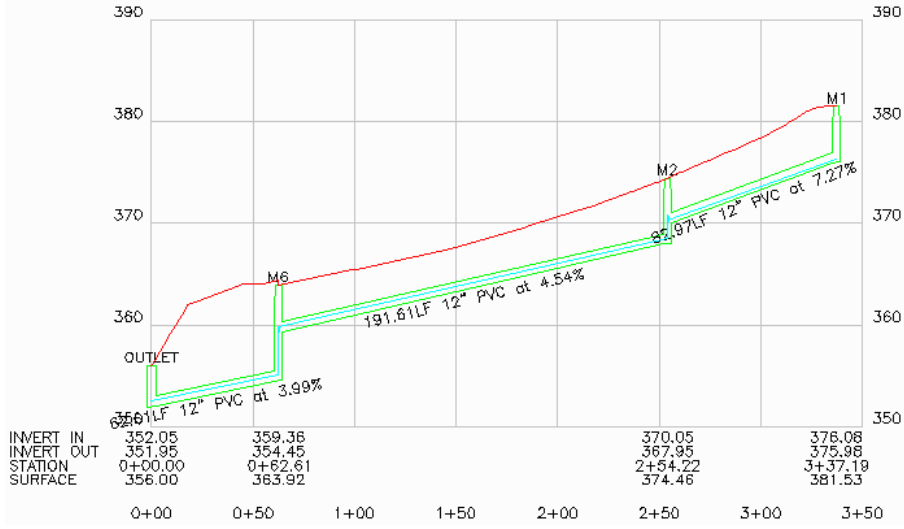


Now there's a prompt to pick the location to draw the profile. First, zoom out to a clear space in the drawing. Then pick the lower left point for the profile. Some of the pipe labels are longer than the pipe segments, and the program prompts whether to draw the labels. Enter Y for yes.
Pick Starting Point for Grid <0.00,0.00>: *pick the lower left profile grid point*
Warning: Text label is longer than the pipe segment.
Plot text anyway [Yes/<No>]? *Y for yes*

Warning: Text label is longer than the pipe segment.
Plot text anyway [Yes/<No>]? *Y for yes*

Since we turned on the option to draw the pipe lateral connections, there's one last dialog to choose the lateral draw options. Pick OK to use the defaults. This will draw circles at the manholes with connections to other pipes.



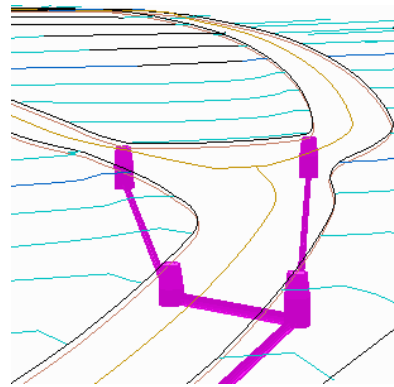


Step 13 - Draw Sewer in 3D

Next, let's draw the sewer network in 3D. Run the Draw Sewer Network > 3D Faces command in the Network menu. This command draws the structures and pipes as 3D Faces. At the command line, press Enter to use the default layer for the 3D Faces. That's all the prompts for this command.

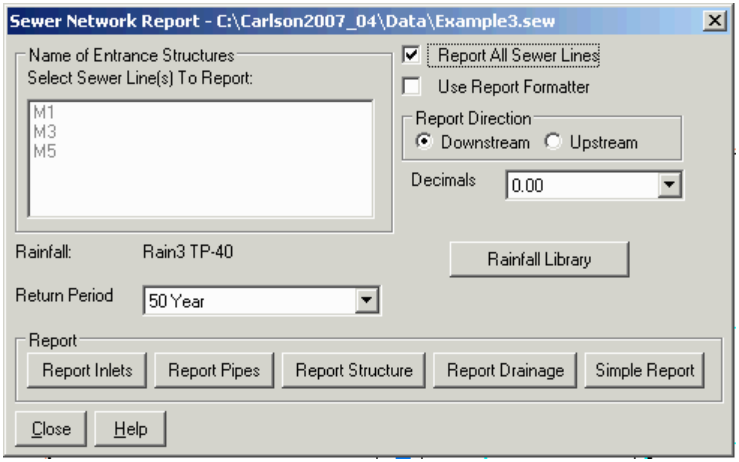
Enter the layer name [SWRNET3D]: *press Enter*

To view the 3D Faces, run the 3D Viewer Window command from the View menu. At the select objects prompt, enter All and press Enter. Then click and drag the mouse to rotate the view to a good viewing angle as described under the Check Surface step. When done inspecting, exit the viewer by picking the Exit Door button.



Step 14 - Report Sewer Network

Finally, let's check out the reports available under the Report Sewer Network command in the Network menu.



In the Sewer Network Report dialog, you can choose which sewer runs to report and the storm event to use. The Report Formatter option allows you to customize which fields to include in the reports and supports outputing the reports to MS Excel and databases. There are specific reports for Inlets, Pipes, Structures and Drainage areas. Let's run the Simple Report to get the summary of our system.

```
 Sewer Network Simple Report
Sewer Network File:  C:\CARLSON2007_04\DATA\example3.sew
 Ground Surface File: C:\CARLSON2007_04\DATA\EXAMPLE3.TIN
 Rainfall ID: Rain3 TP-40
 Return Period: 50 Year
System A
 Sewer Line From M1 To OUTLET (Upstream to Downstream)
 Name      Station    Invert-In      Invert-Out    Rim Elev       Area(SF)       Flow Dep
           Distance   Slope(ft/ft)   Size(in)      Min Cover(ft)  Direction
 M1        0+00.00                   376.03        381.53         17194.63       3.19
           82.97      0.0727         12.00         3.46           S 09°44'01'' W
 M2        0+82.97    370.00         368.00        374.46         16498.13       3.19
           191.61     0.0454         12.00         3.39           S 28°23'46'' W
```

M6	2+74.58	359.31	354.50	363.92	2167.78	6.25
	62.61	0.0399	12.00	3.00	S 32°48'10'' E	
OUTLET	3+37.19	352.00	352.00	356.00	0.00	7.16

System A

Sewer Line From M3 To OUTLET (Upstream to Downstream)

Name	Station	Invert-In	Invert-Out	Rim Elev	Area(SF)	Flow Dep
	Distance	Slope(ft/ft)	Size(in)	Min Cover(ft)	Direction	
M3	0+00.00		376.00	381.50	8488.16	4.45
	58.58	0.0836	9.00	2.79	S 06°06'48'' E	
M4	0+58.58	371.10	371.00	374.64	10015.40	8.83
	21.69	0.0415	9.00	2.89	S 62°21'49'' E	
M2	0+80.28	370.10	368.00	374.46	16498.13	4.44
	191.61	0.0454	12.00	3.39	S 28°23'46'' W	
M6	2+71.89	359.31	354.50	363.92	2167.78	6.25
	62.61	0.0399	12.00	3.00	S 32°48'10'' E	
OUTLET	3+34.50	352.00	352.00	356.00	0.00	7.16

System A

Sewer Line From M5 To OUTLET (Upstream to Downstream)

Name	Station	Invert-In	Invert-Out	Rim Elev	Area(SF)	Flow Dep
	Distance	Slope(ft/ft)	Size(in)	Min Cover(ft)	Direction	
M5	0+00.00		359.53	364.03	2182.16	4.25
	21.81	0.0100	6.00	4.00	S 52°50'57'' E	
M6	0+21.81	359.31	354.50	363.92	2167.78	4.23
	62.61	0.0399	12.00	3.00	S 32°48'10'' E	
OUTLET	0+84.42	352.00	352.00	356.00	0.00	7.16

This completes the Lesson 12 tutorial: Stormwater Network Design.

LDT Migration Guide

Introduction

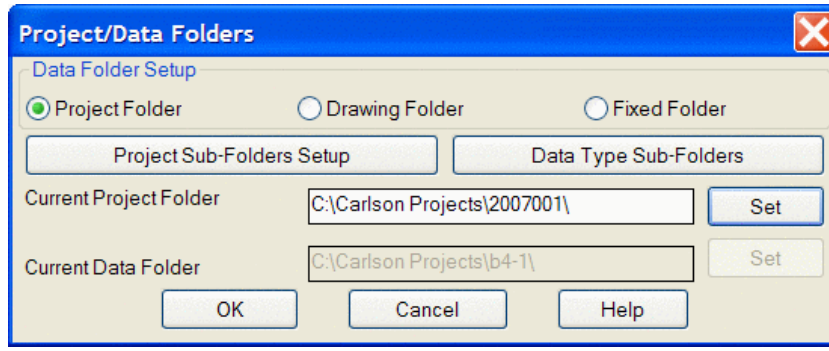
Carlson Civil 2007 is the new flagship office product from Carlson Software, encompassing all of the functionality of Survey, Site Grading, Road Design, Hydrology and GIS, along with a comprehensive set of drafting and annotation tools. Carlson Civil 2007 runs atop any installed AutoCAD executable, running as plain AutoCAD, or found within Map, Land Desktop or Civil 3D, versions 2000-2007.

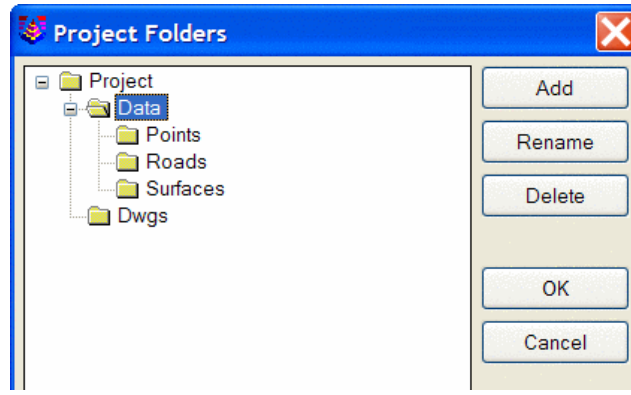
Evolved from the Carlson SurvCADD product line, first introduced in 1989, Carlson Civil 2007 introduces several brand new state of the art tools, including a dynamic road design program called RoadNet, and a dynamic storm drain design program called SewerNet. While these functions automatically respond to design changes, adjusting sections, profiles, and grading, Carlson Civil 2007 accomplishes this automation without introducing custom objects, so sharing drawings with others is not an issue.

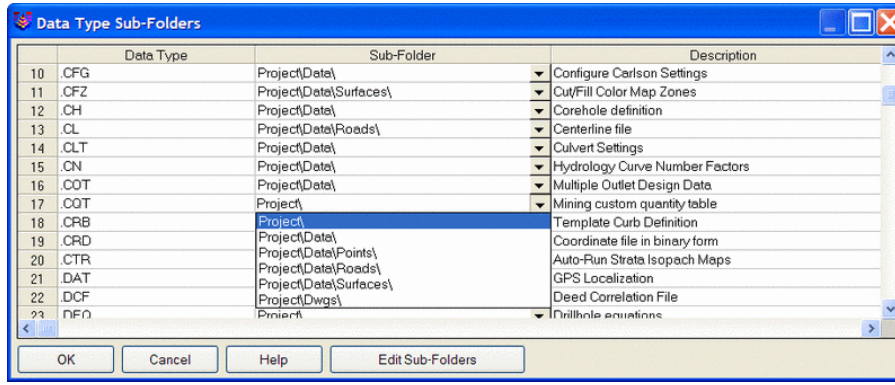
Carlson Civil 2007 continues the Carlson Software tradition of unlimited free tech support, so when needed, help is always a free phone call away, and also introduces the newest support technology in the form of an online, web-based reference manual, complete with demonstration and training movies.

Data File Types and Storage

Carlson Civil has a similarity to Land Desktop in the use of external files to store design data, but differs significantly in that in Carlson Civil the naming and placement of these files is determined by the user, not the software. Carlson Civil offers three distinct methods of file storage, the choice is up to the end user. Carlson Civil data files can either be placed in a single location, known as a data folder, placed with the drawing they are associated with, or placed in a user-defined folder structure. The placement of files within that structure is also totally user-defined, based on the assignment of file types (extensions) to folders.


Project/Data Folders
Data Folder Setup
Project Folder
Drawing Folder
Fixed Folder
Project Sub-Folders Setup
Data Type Sub-Folders
Current Project Folder
C:\Carlson Projects\2007001\
Set
Current Data Folder
C:\Carlson Projects\b4-1\
Set
OK
Cancel
Help


Project Folders
Project
Data
Points
Roads
Surfaces
Dwgs
Add
Rename
Delete
OK
Cancel


Data Type Sub-Folders
Data Type
Sub-Folder
Description
10 .CFG Project\Data\ Configure Carlson Settings
11 .CFZ Project\Data\Surfaces\ Cut/Fill Color Map Zones
12 .CH Project\Data\ Corehole definition
13 .CL Project\Data\Roads\ Centerline file
14 .CLT Project\Data\ Culvert Settings
15 .CN Project\Data\ Hydrology Curve Number Factors
16 .COT Project\Data\ Multiple Outlet Design Data
17 .CQT Project\ Mining custom quantity table
18 .CRB Project\ Template Curb Definition
19 .CRD Project\Data\ Coordinate file in binary form
20 .CTR Project\Data\Points\ Auto-Run Strata Isopach Maps
21 .DAT Project\Data\Roads\ GPS Localization
22 .DCF Project\Data\Surfaces\ Deed Correlation File
23 .DFQ Project\Dwgs\ Drillhole equations
OK
Cancel
Help
Edit Sub-Folders

File types used by Carlson Civil include:

.crd - Point data, coordinate file

.rw5 - raw survey data, contains all observations

.cl - centerline, describes a 2D alignment

.tin - Surface, newer format, more efficient than .flt in most cases, especially for machine control

.flt - Surface, original format

.grd - Surface grid file, used for volumes

.cfg - Stores configuration settings

.fld - Field to Finish file, stores rules for inserting symbols for points (LDT Description Key functionality) and automated linework functionality (Autodesk Survey Figures equivalent)

.lot - Lot file, stores parcel geometry

.adf - Annotation Default file

.pro - Profile file

.mxs - Section Alignment file

.grp - Point Group definitions

.rdn - Roadway Networks

.sct - Road Sections

.tpl - Road Templates

.rdf - Road Design Files

Settings

Carlson Civil uses several techniques to store settings. There are three main categories of settings; Drawing Setup settings, such as drawing scale and units, Command-specific settings, such as the layer to draw contours on, and Generic control settings, such as whether to link drawing points to the external coordinate file (.CRD).

Drawing Setup settings are stored directly within the drawing files (.DWG). Carlson Civil also creates a file for each drawing using the drawing name with a (.INI) file extension. This file stores a list of all of the design files that are used or created from within the drawing, such as centerline files (.CL), profile files, (.PRO), etc.

Command-specific settings are stored within a set of files with (.INI) file extensions, with the command name as a filename, such as roadnet.ini, or mapcheck.ini. These are typically stored in the \USER folder, and are created as the commands are first accessed.

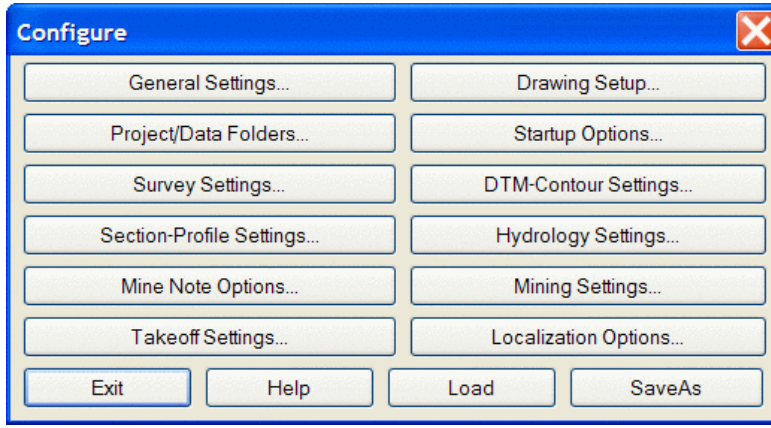
Generic control settings are stored within a special (.INI) file named Carlson.ini. When new drawings are created, this file is read to set these type of generic controls.

Drawing Setup settings can be accessed directly from the Settings menu, or through the Configure command. If the Drawing Setup dialog is accessed through the Configure command, when exiting the main Configure dialog, the user is prompted whether to save changes to Current and Future drawings, or Future drawings only. Current and Future saves the Drawing Setup settings to the current drawing internally, and updates the Carlson.ini file, while the choice of Future Only does not affect the current drawing, only the Carlson.ini file, and therefore any new drawings created. To change Drawing Setup settings for only the current drawing, do not go through Configure, but use the Drawing Setup command directly off of the Settings menu.

Command-specific settings are accessed when the commands are actually run. The settings displayed are being read from the command's own specific (.INI) file, and any changes made are written to the same files. This way the commands automatically recall the settings that were used for the previous run. Alternatively, the Configure command can be used to access command-specific settings.

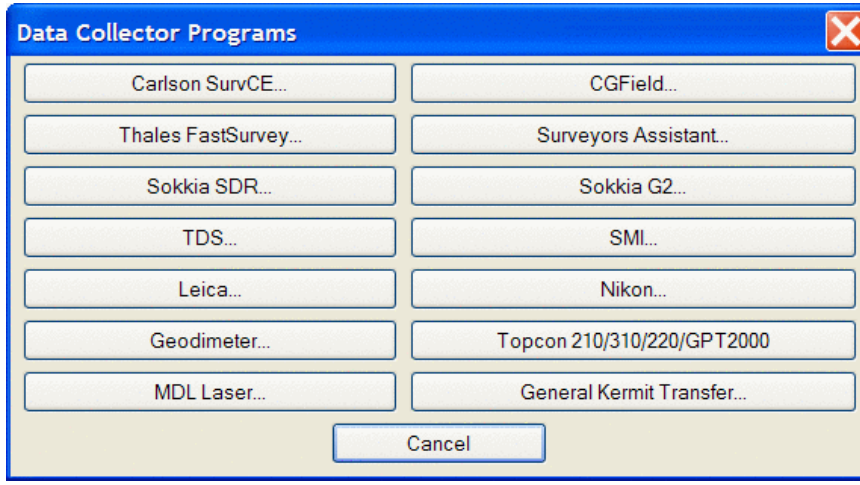
The Configure command provides access to a dialog box with 12 buttons, each leading to settings

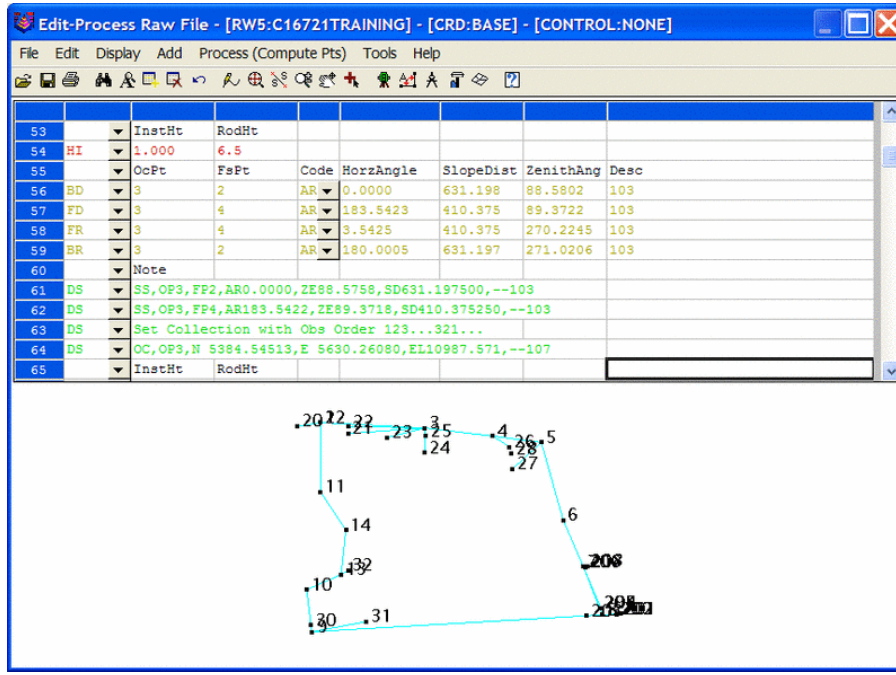
for specific aspects of the software. Changes made within any of these are also automatically saved to the corresponding command (.INI) file, or to the Carlson.ini file in the case of generic settings. The Configure command also provides a Save and Load functionality, utilizing configuration files (.CFG). Saving a configuration file (.CFG) saves all settings currently stored in all of the command-specific (.INI) files, and the Carlson.ini file. Loading a configuration file (.CFG) sets all settings within all these files.



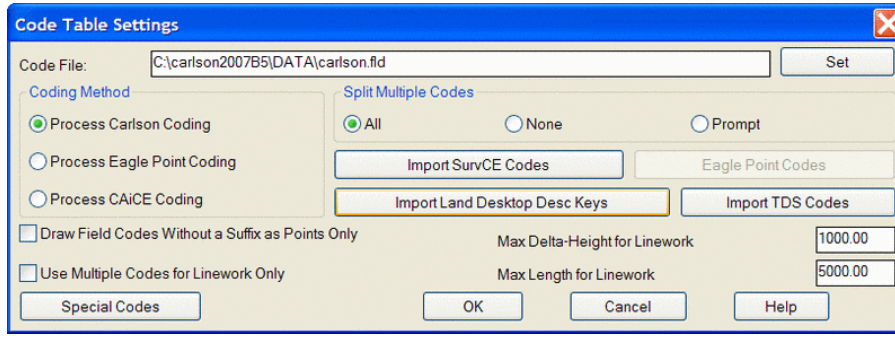
Survey

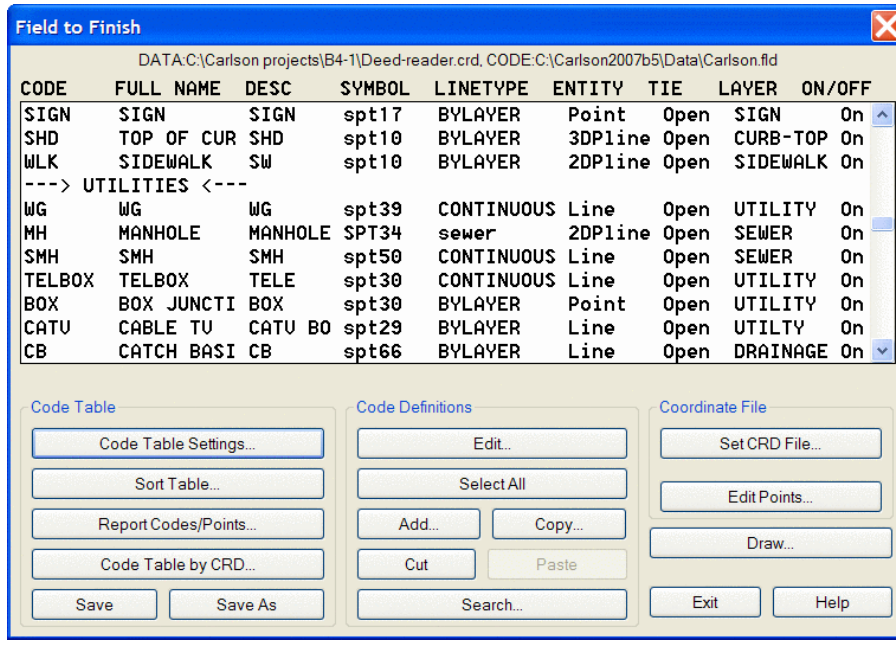
The complete range of Survey functionality is contained within the Carlson Civil, and is also available in the Carlson Survey program. This includes communication with data collectors, editing and processing of raw survey data, including traverse adjustment, and Field to Finish, which controls the generation of point symbols and linework.

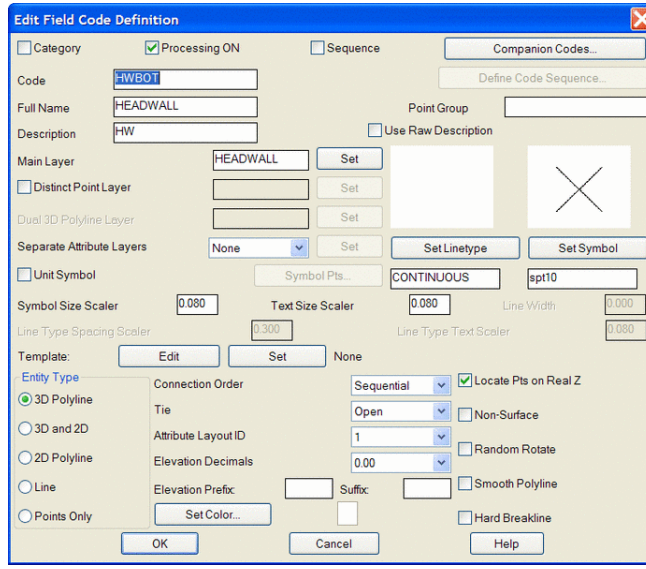

Data Collector Programs
Carlson SurvCE...
CGField...
Thales FastSurvey...
Surveyors Assistant...
Sokkia SDR...
Sokkia G2...
TDS...
SMI...
Leica...
Nikon...
Geodimeter...
Topcon 210/310/220/GPT2000
MDL Laser...
General Kermit Transfer...
Cancel


Edit-Process Raw File - [RW5:C16721TRAINING] - [CRD:BASE] - [CONTROL:NONE]
File Edit Display Add Process (Compute Pts) Tools Help
53 InstHt RodHt
54 HI 1.000 6.5
55 OcPt FsPt Code HorzAngle SlopeDist ZenithAng Desc
56 BD 3 2 AR 0.0000 631.198 88.5802 103
57 FD 3 4 AR 183.5423 410.375 89.3722 103
58 FR 3 4 AR 3.5425 410.375 270.2245 103
59 BR 3 2 AR 180.0005 631.197 271.0206 103
60 Note
61 DS SS,OP3,FP2,AR0.0000,ZE88.5758,SD631.197500,--103
62 DS SS,OP3,FP4,AR183.5422,ZE89.3718,SD410.375250,--103
63 DS Set Collection with Obs Order 123...321...
64 DS OC,OP3,N 5384.54513,E 5630.26080,EL10987.571,--107
65 InstHt RodHt

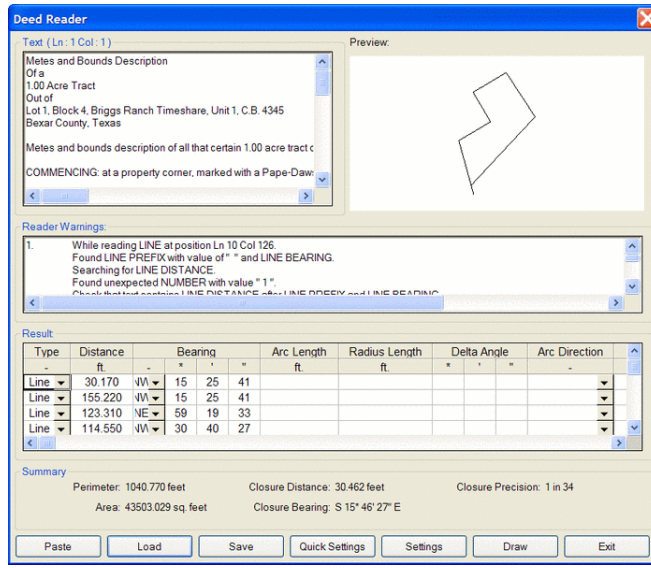
Land Desktop uses Description Keys for point-based symbol insertion, and Autodesk Survey uses Figure notation for the generation of linework. Autodesk requires field coding to produce linework, and the processing of that information takes place when the raw file (.fbk) is Imported. Carlson inserts symbols and linework with one function known as Field to Finish (F2F), and performs this task using the point descriptions from the coordinate file, not the raw observations file. So linework can actually be generated from any set of points, even if no field coding has taken place. However, the addition of field coding can certainly make the generation of linework more precise. Carlson Civil can use LDT Description Key file to start a Field to Finish Code File.

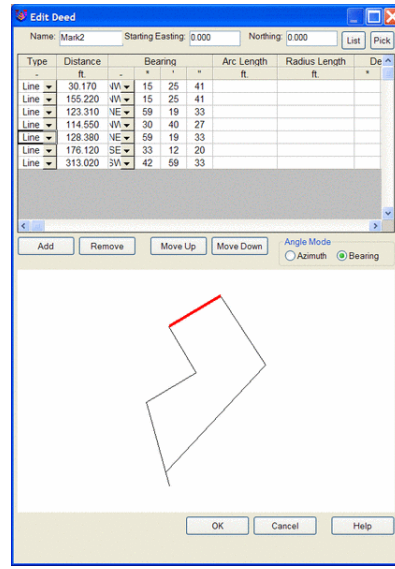



Field to Finish
DATA:C:\Carlson projects\B4-1\Deed-reader.crd, CODE:C:\Carlson2007b5\Data\Carlson.fld
CODE FULL NAME DESC SYMBOL LINETYPE ENTITY TIE LAYER ON/OFF
SIGN SIGN SIGN spt17 BYLAYER Point Open SIGN On
SHD TOP OF CUR SHD spt10 BYLAYER 3DPline Open CURB-TOP On
WLK SIDEWALK SW spt10 BYLAYER 2DPline Open SIDEWALK On
---> UTILITIES <---
WG WG WG spt39 CONTINUOUS Line Open UTILITY On
MH MANHOLE MANHOLE SPT34 sewer 2DPline Open SEWER On
SMH SMH SMH spt50 CONTINUOUS Line Open SEWER On
TELBOX TELBOX TELE spt30 CONTINUOUS Line Open UTILITY On
BOX BOX JUNCTI BOX spt30 BYLAYER Point Open UTILITY On
CATV CABLE TV CATV BO spt29 BYLAYER Line Open UTILTY On
CB CATCH BASI CB spt66 BYLAYER Line Open DRAINAGE On
Code Table
Code Table Settings...
Sort Table...
Report Codes/Points...
Code Table by CRD...
Save
Save As
Code Definitions
Edit...
Select All
Add...
Copy...
Cut
Paste
Search...
Coordinate File
Set CRD File...
Edit Points...
Draw...
Exit
Help

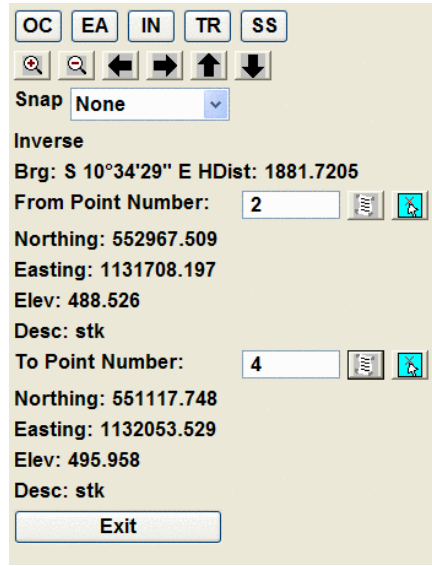

Edit Field Code Definition
Category
Processing ON
Sequence
Companion Codes...
Code
HWBOT
Define Code Sequence...
Full Name
HEADWALL
Point Group
Description
HW
Use Raw Description
Main Layer
HEADWALL
Set
Distinct Point Layer
Dual 3D Polyline Layer
Separate Attribute Layers
None
Set Linetype
Set Symbol
Unit Symbol
Symbol Pts...
CONTINUOUS
spt10
Symbol Size Scaler
0.080
Text Size Scaler
0.080
Line Width
0.000
Line Type Spacing Scaler
0.300
Line Type Text Scaler
0.080
Template:
Edit
Set
None
Entity Type
3D Polyline
3D and 2D
2D Polyline
Line
Points Only
Connection Order
Sequential
Locate Pts on Real Z
Tie
Open
Non-Surface
Attribute Layout ID
1
Random Rotate
Elevation Decimals
0.00
Elevation Prefix:
Suffix:
Smooth Polyline
Set Color...
Hard Breakline
OK
Cancel
Help

Carlson Civil also has powerful functions to Enter Deeds to draw linework, and a Deed Reader which reads a text file of a deed and extracts the data needed to define and draw the deed in the drawing.





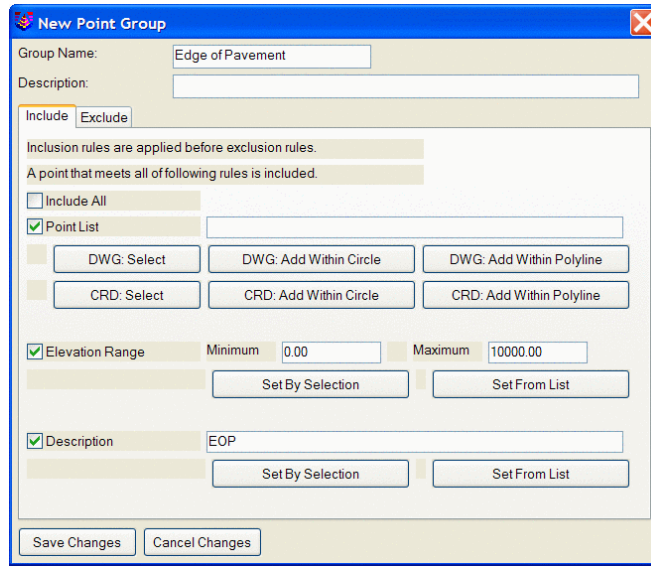
Carlson Civil also has a sidebar COGO function called Visual COGO to enter Traverse, Sideshot and other survey data.



Points and Point Groups

This use of point data in Carlson Civil revolves around the use of .crd files, also known as coordinate files.

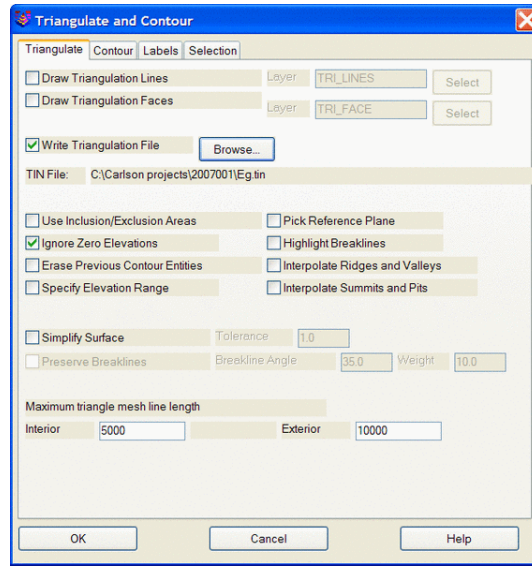
Carlson Civil supports the creation of Point Groups similar to LDT and applies them in many applications, such as using them to create surfaces, editing and listing. Carlson Civil stores Point Group definitions are associated individually to each .crd file.



Surfaces and Contours

In Carlson Civil, Surfaces can be written out as external files, but a lot of design and computations involving surfaces can also be accomplished directly within the drawing without writing out external files. Triangulation surfaces can be written out as .tin or .flt and grid surfaces as .grd files. When an external file is generated, a named Surface is also stored in the drawing. This named Surface is accessed through the Surface Manager, where it can be edited.

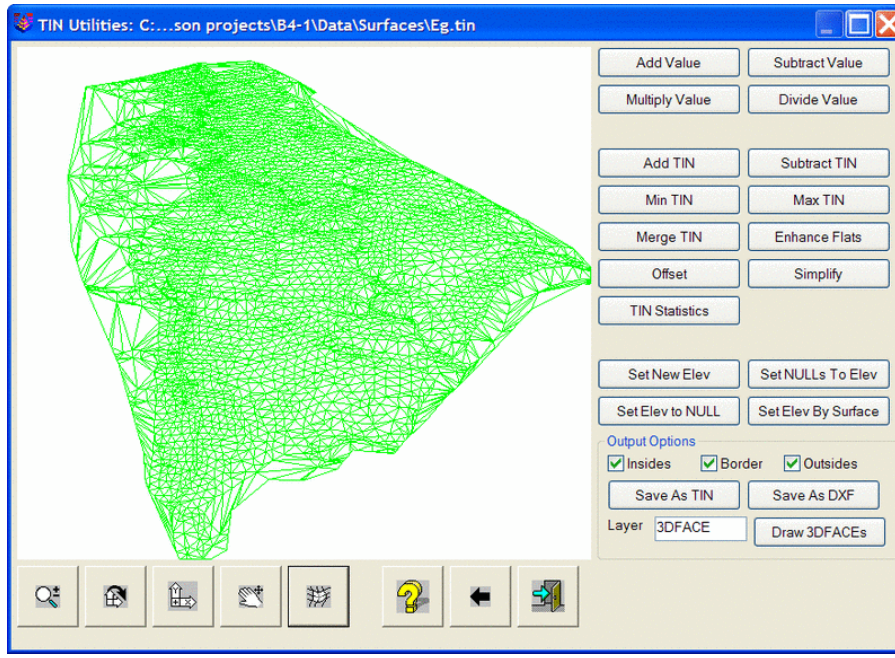
The main Carlson Civil command for working with Surfaces is called Triangulate and Contour. It is a single dialog box with four tabs, and covers the entire process of specifying the general settings to generate the Surface, creating Contours, generating Labels, and specifying the data source(s) for the Surface.



In Carlson Civil, Contours are generated as regular AutoCAD Polylines. Contours can be generated and automatically labeled simultaneously, or labeled after they are generated. Labels can be generated with wipeouts to hide the contour beneath them, and can also be slid along the contour to easily change their location.

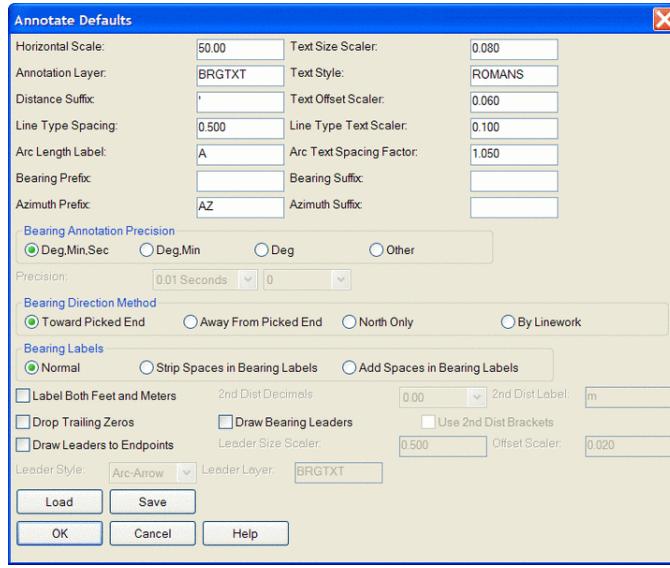
The Triangulation Surface Manager has tools to edit, add and remove data points and breaklines and update the triangulation dynamically. It also allows you to change the display properties for the triangulation, contours and labels.

The TIN Utilities function provides a powerful set of editing tools.

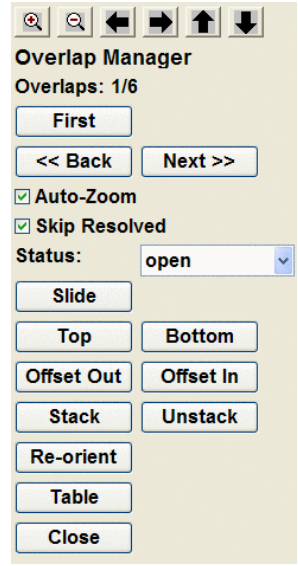


Line and Curve Labeling

Carlson Civil refers to the process of labeling lines and curves as Annotation. Lines and curves can be labeled in a dynamic or static mode, depending on the label settings.



There is also a powerful set of tools to check for and correct overlapping labels.



Volumes

There are several ways to generate volumetric calculations within Carlson Civil. Volumes By Layers, Volumes by Triangulation, Calculate Section Volumes and Two Surface Volumes (Grid volumes).

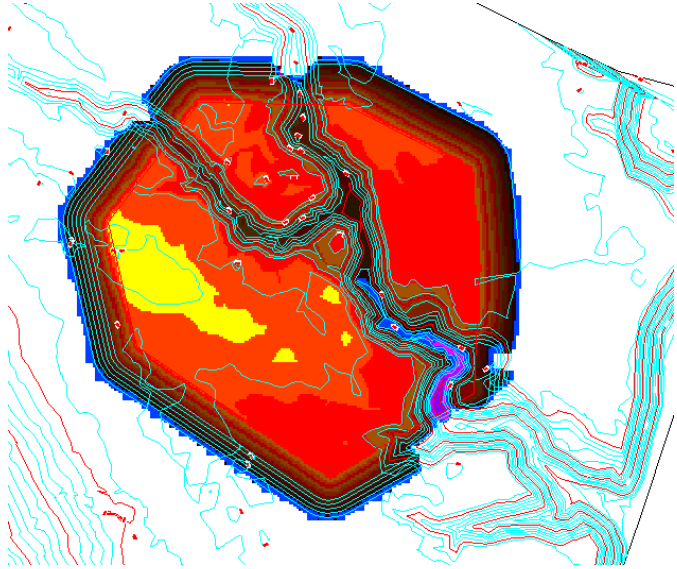
Volumes by Layers is potentially the quickest method. It needs no existing data files and creates no files in the process. You simply specify which layers to use for each of the 2 surfaces.

Volumes by Triangulation uses two triangulated surface files as the source of the data. These files are created through the Triangulate and Contour command. You can choose to create contours in the drawing when you create the TIN files, or just create the files without generating contours.

Calculate Section Volumes calculates volumes by end areas from two cross section files.

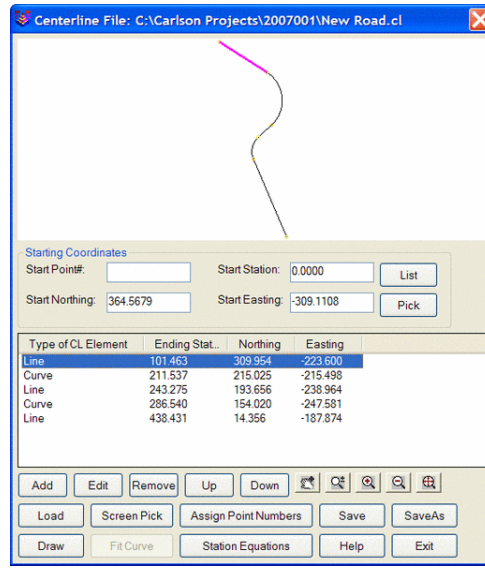
The Two Surface Volumes method uses two predefined Surface files as the data source for the calculations.

Once calculated, you can generate Cut and Fill Color Maps, Cut and Fill Centroids, and Cut and Fill Labels to illustrate the volumes.



Alignments

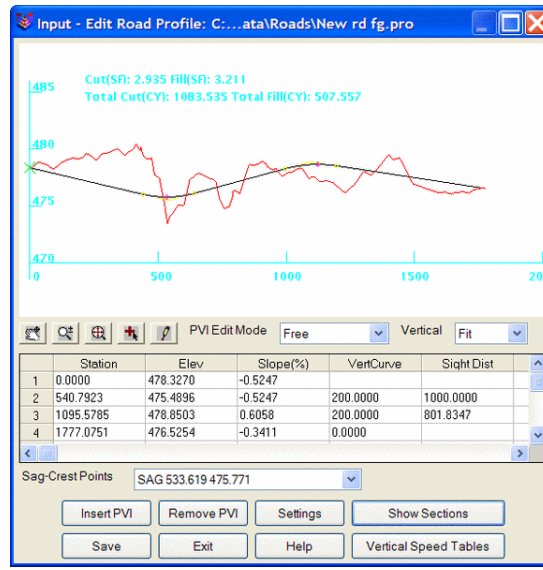
Horizontal Alignments in Carlson Civil are known as Centerlines. They are stored in .cl files. They can be created and edited through the Input-Edit Centerline File command. Polylines can be drawn first and then used to define Centerlines. Once defined as a centerline, double-clicking on the polyline invokes the Input-Edit dialog box.



Profiles

Profiles are stored within .pro files, with user-defined names. Existing Ground/Surface Profiles and Proposed Finished Grade/Design Profiles both use this filetype. Multiple .pro files can be drawn on the same Profile Grid.

There are several different routines for creating profiles including Profiles From Triangulation Files, Profile From Surface Entities and Profile From Points On Centerline. Before using these profile creation routines, the horizontal alignment needs to be created as a centerline file or polyline. The Quick Profile routine can be used to create profiles in one step.

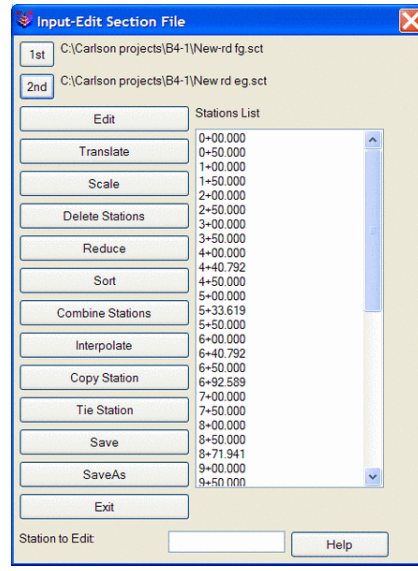


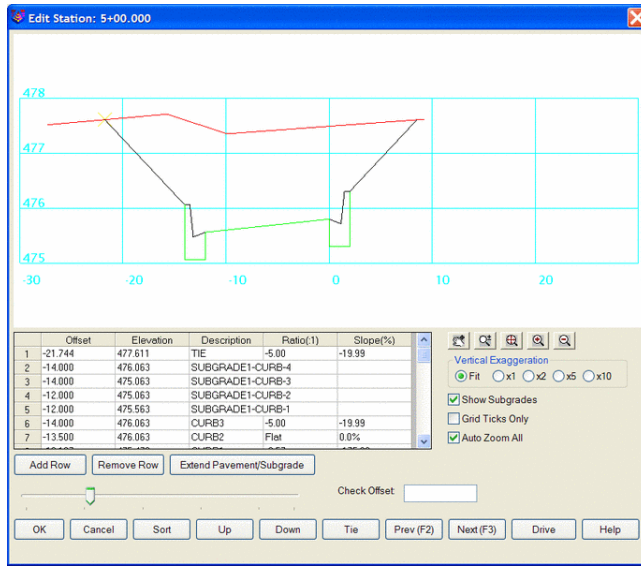
When using Process Road Design or RoadNet, the existing ground Profile can be generated automatically as part of the process, simply by specifying the Surface to use, and so is not a separate prerequisite. The Proposed Finish Grade Profile can then be added in the editor, and the Roadway processed, all without ever drawing anything in the drawing itself. The more traditional LDT approach of generating an existing ground Profile in the drawing and then adding a proposed finish grade Profile by drawing on it in the drawing is also an option.

Roadway Cross Sections

Roadway Cross Sections are based on Cross Section Alignments (.mxs files) that are defined by the Input-Edit Section Alignment command to set the station interval and max offsets left and right. Similar to profile creation, there are several routines to create sections including Sections From Triangulation, Sections From Surface Entities and Sections From Points. The Process Road Design and RoadNet commands can create final sections.

Once section files (.sct) are created, the Input-Edit Section File command allows you to review and edit the section data. Also the Draw Section File and Section Report commands can be used.

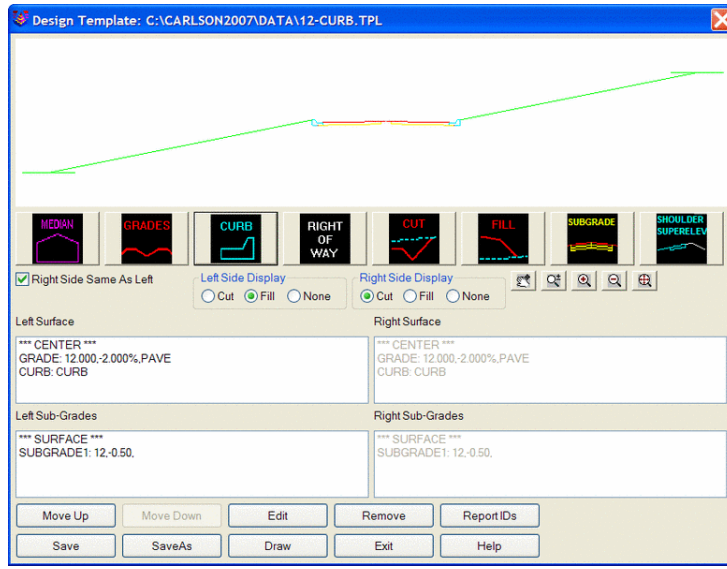


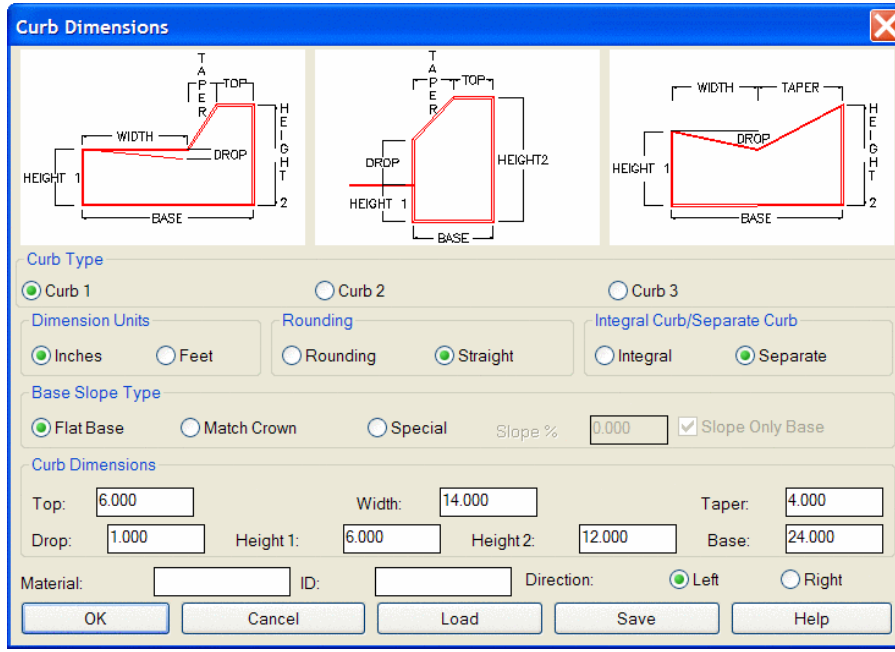


Roadway Templates

Roadway Templates are created within the Design Template dialog box. They are stored as .tpl files, and can be applied to any road design. Templates are used in Process Road Design, Road Network and within the Input-Edit Road Profile dialog.

The Design Template defines the road grades, subgrades, curb, superelevation break points and cut/fill slope treatments.


Design Template: C:\CARLSON2007\DATA\12-CURB.TPL
MEDIAN
GRADES
CURB
RIGHT OF WAY
CUT
FILL
SUBGRADE
SHOULDER SUPERELEV
Right Side Same As Left
Left Side Display
Cut Fill None
Right Side Display
Cut Fill None
Left Surface
*** CENTER ***
GRADE: 12.000,-2.000%,PAVE
CURB: CURB
Right Surface
*** CENTER ***
GRADE: 12.000,-2.000%,PAVE
CURB: CURB
Left Sub-Grades
*** SURFACE ***
SUBGRADE1: 12,-0.50,
Right Sub-Grades
*** SURFACE ***
SUBGRADE1: 12,-0.50,
Move Up
Move Down
Edit
Remove
Report IDs
Save
SaveAs
Draw
Exit
Help


Curb Dimensions
TAPER
TOP
WIDTH
DROP
HEIGHT 1
HEIGHT 2
BASE
TAPER
TOP
DROP
HEIGHT 1
HEIGHT2
BASE
WIDTH
TAPER
DROP
HEIGHT 1
HEIGHT 2
BASE
Curb Type
Curb 1
Curb 2
Curb 3
Dimension Units
Inches
Feet
Rounding
Rounding
Straight
Integral Curb/Separate Curb
Integral
Separate
Base Slope Type
Flat Base
Match Crown
Special
Slope %
0.000
Slope Only Base
Curb Dimensions
Top: 6.000
Width: 14.000
Taper: 4.000
Drop: 1.000
Height 1: 6.000
Height 2: 12.000
Base: 24.000
Material:
ID:
Direction:
Left
Right
OK
Cancel
Load
Save
Help

Design Control

The idea of Design Control in LDT exists in Carlson Civil in a number of places.

- Template Control - Templates are assigned to centerlines either in the Process Road Design dialog box, or in the Input-Edit Road Profile dialog.
- Slope Control - In Carlson Civil, side slopes are actually part of the Template definition.
- Ditches - Ditches are defined within the Design Template as part of the cut/fill treatment.

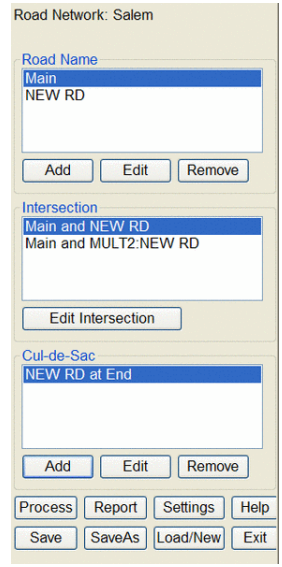
Transitions - There are four methods to work with Transitions in Carlson Civil.

The first is called a Template Series, in which multiple Templates are assigned to a single Centerline at different stations. Next is a Template transition, in which a single Template is assigned to the entire Centerline and the user edits it at different stations. Next is a Template Point Centerline, in which a secondary Centerline is defined and attached to a point on the Template for specific horizontal control, such as a lane widening. Last is a Template Point Profile, in which an additional Profile is defined and attached to a point on the Template for specific vertical control, like the flow line of a ditch.

Superelevations - The template breakpoints for superelevation pivots are defined within Design Template. The stations for the superelevation transitions are set in the Input-Edit Superelevation command.

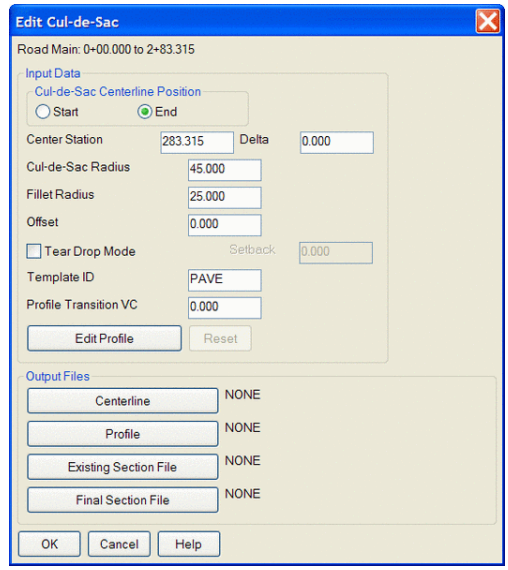
Roadway Intersections

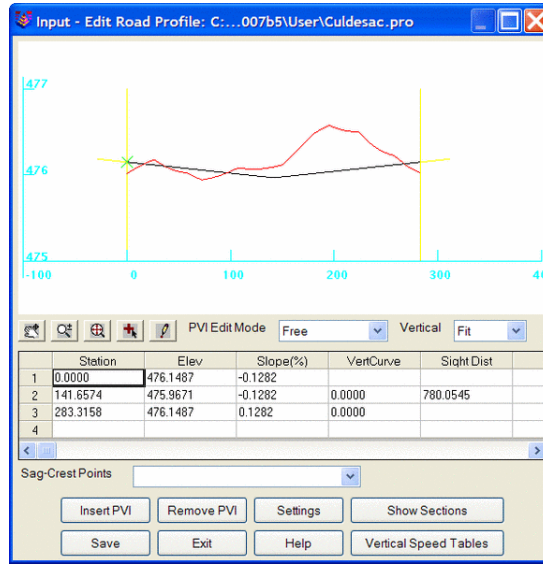
One of the very exciting features of Carlson Civil is the use of Roadway Networks. These are sets of centerlines that are aware of each other and clean up at intersections, horizontally and vertically.



Cul-de-sacs

Cul-de-sacs are handled elegantly with the Road Network. Cul-de-sacs can be easily added to any roadway, and designed at a very detailed level, including a profile for the circumference.


Edit Cul-de-Sac
Road Main: 0+00.000 to 2+83.315
Input Data
Cul-de-Sac Centerline Position
Start
End
Center Station
283.315
Delta
0.000
Cul-de-Sac Radius
45.000
Fillet Radius
25.000
Offset
0.000
Tear Drop Mode
Setback
0.000
Template ID
PAVE
Profile Transition VC
0.000
Edit Profile
Reset
Output Files
Centerline
NONE
Profile
NONE
Existing Section File
NONE
Final Section File
NONE
OK
Cancel
Help


Input - Edit Road Profile: C:...007b5\User\Culdesac.pro
477
476
475
-100
0
100
200
300
PVI Edit Mode
Free
Vertical
Fit
Station
Elev
Slope(%)
VertCurve
Sight Dist
1
0.0000
476.1487
-0.1282
2
141.6574
475.9671
-0.1282
0.0000
780.0545
3
283.3158
476.1487
0.1282
0.0000
4
Sag-Crest Points
Insert PVI
Remove PVI
Settings
Show Sections
Save
Exit
Help
Vertical Speed Tables

Grading

Carlson Civil includes a variety of tools to accomplish the task of grading, including point commands, 3D polylines commands, contour commands and a grading mechanism known as a Pad Template, which is essentially the equivalent of an LDT Grading Object. Pad Templates provide some significant improvements, however, such as the ability to have a separate surface for the area inside the "pad", which moves horizontally and vertically with edits to the pad, and the ability to use a template for the side slopes, so they can project complex grading designs.

LandXML Data Transfer

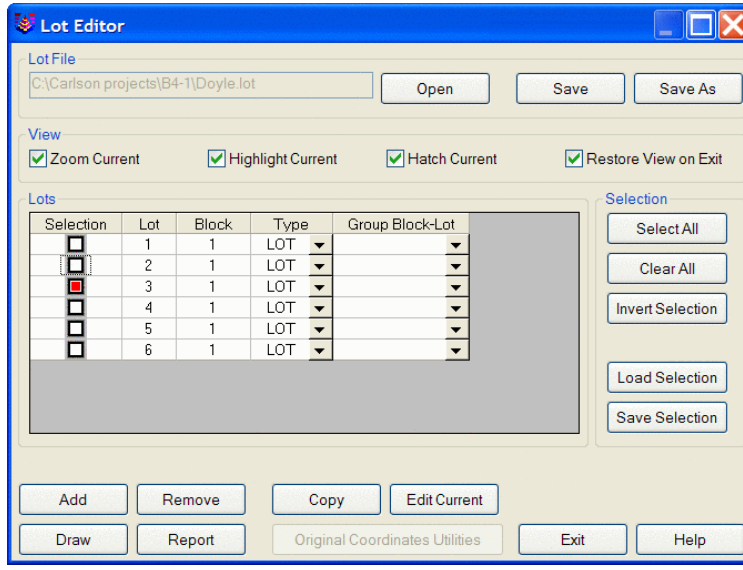
Transfer of data between LDT and Carlson Civil can be accomplished in several ways, depending on the type of data in question, but the best overall method is the use of LandXML files.

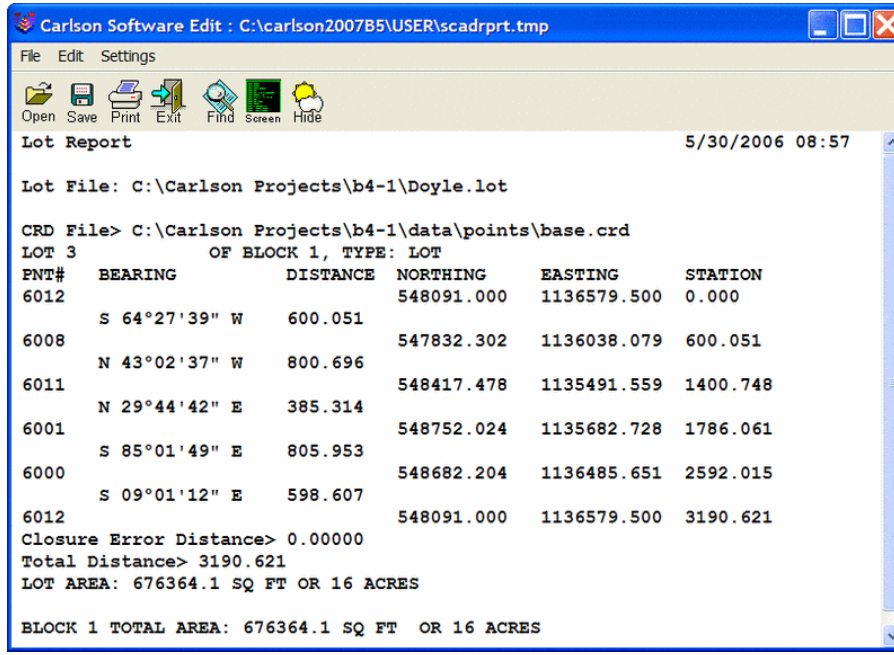
Pipes

Pipe Profiles can be designed and edited in the Input-Edit Profile dialog, and then drafted in the drawing. In Hydrology, Pipe Networks can be created, which are dynamic and "intelligent", and so automatically respond to design changes.

Lots

Carlson Civil includes a set of tools for lot layout and lot design. Defined lots can be stored in a lot file (.lot). Another way to define a set of Lots automatically is with the Lot by Enclosed Text command, which searches for closed areas with enclosed text, and creates lots out of them, using the enclosed text for the lot name/number. Defined Lots can be accessed and edited through the Lot Editor.




Carlson Software Edit : C:\carlson2007B5\USER\scadrprt.tmp
File Edit Settings
Open Save Print Exit Find Screen Hide
Lot Report 5/30/2006 08:57
Lot File: C:\Carlson Projects\b4-1\Doyle.lot
CRD File> C:\Carlson Projects\b4-1\data\points\base.crd
LOT 3 OF BLOCK 1, TYPE: LOT
PNT# BEARING DISTANCE NORTHING EASTING STATION
6012 548091.000 1136579.500 0.000
S 64°27'39" W 600.051
6008 547832.302 1136038.079 600.051
N 43°02'37" W 800.696
6011 548417.478 1135491.559 1400.748
N 29°44'42" E 385.314
6001 548752.024 1135682.728 1786.061
S 85°01'49" E 805.953
6000 548682.204 1136485.651 2592.015
S 09°01'12" E 598.607
6012 548091.000 1136579.500 3190.621
Closure Error Distance> 0.00000
Total Distance> 3190.621
LOT AREA: 676364.1 SQ FT OR 16 ACRES
BLOCK 1 TOTAL AREA: 676364.1 SQ FT OR 16 ACRES

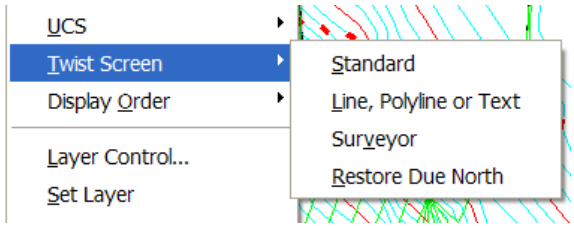
Text Height

In LDT, as part of drawing setup, a set of text styles is created based on information contained in a file with a .STP file extension, most commonly used is the LEROY.STP. These text styles all have fixed heights assigned to them, based on the current horizontal scale set in the drawing. If the horizontal scale is changed, the heights of the text styles are all changed.

In Carlson Civil, each of the various commands that involve annotation set the text style to be used and the desired height for the text, using a "scaler", which is multiplied by the current drawing scale. The AutoCAD text style should be set with a height of zero.

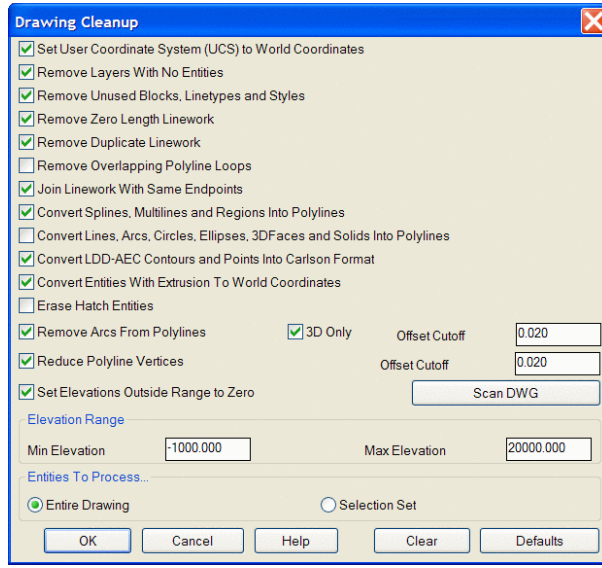
North Rotation

Carlson Civil does not support the concept of a secondary UCS to define and store North, as is done with LDT North Rotation. Instead, Carlson Civil relies on the use of DVIEW Twist to reorient North, and contains a thorough set of tools to work with that command. Any LDT drawings that are going to be brought into Carlson Civil should first have their LDT Base Point and North Rotation checked. If they are not all zeros, they should all be set to 0, have all points inserted to the drawing, and all linework moved and rotated to the location of the points.



Drawing Cleanup

If you're not running Carlson Civil on top of Map, or even if you are, Carlson Civil includes an awesome Drawing Cleanup function to find and resolve a wide range of common drawing problems.


Drawing Cleanup
Set User Coordinate System (UCS) to World Coordinates
Remove Layers With No Entities
Remove Unused Blocks, Linetypes and Styles
Remove Zero Length Linework
Remove Duplicate Linework
Remove Overlapping Polyline Loops
Join Linework With Same Endpoints
Convert Splines, Multilines and Regions Into Polylines
Convert Lines, Arcs, Circles, Ellipses, 3DFaces and Solids Into Polylines
Convert LDD-AEC Contours and Points Into Carlson Format
Convert Entities With Extrusion To World Coordinates
Erase Hatch Entities
Remove Arcs From Polylines
3D Only
Offset Cutoff
0.020
Reduce Polyline Vertices
Offset Cutoff
0.020
Set Elevations Outside Range to Zero
Scan DWG
Elevation Range
Min Elevation
-1000.000
Max Elevation
20000.000
Entities To Process...
Entire Drawing
Selection Set
OK
Cancel
Help
Clear
Defaults

Programming Interfaces

Coordinates

Overview

We have created a Lisp file, CrdAPI.FAS, that contains some simple and easy-to-use functions for accessing and modifying any type of coordinate file that Carlson Software supports. The CrdAPI.FAS file is located in the Carlson LSP folder. This collection of functions can help you write your own tools. We call this toolkit the Coordinate File Application Programming Interface, or CRD API.

This document describes the Lisp interface of the CRD API.

Supported Types of Coordinate Files

The following enumerated variables are available for specifying the different types of coordinate files that are supported by the CRD API.

```
;;;; Coordinate File format number


(setq
enCrdTypeUnrecognized -2 ;file exists but is not a recognized
type.
enCrdInvalid -1 ;not a valid type - used in creating new files.
enCrdSurvCADDNumeric 0 ;Carlson original; point name is numeric.
Extension ''crd''.
enCrdSurvCADDAlpha 1 ;SurvCADD sequel; point names can be
alphanumeric.  Extension ''crd''.
enCrdMemory 2 ;NOT YET IMPLEMENTED.
enCrdCgAlpha 3 ;C&G alphanumeric.  Extension ''cgc''.
enCrdCgNumeric 4 ;C&G numeric.  Extension ''crd''.
enCrdSimplicity 5 ;Simplicity ''Sight Survey''.  Extension is
''zak''.
enCrdLDD 6 ;Land Desktop Development.  Filename is
''points.mdb''.
enCrdCivil3D 7 ;Civil 3D; point name is numeric.
)
```

Working with Points in Coordinate Files

The following functions are for working with Crd Point structures.

Internally, the Crd Point looks like the following list.

```
(name desc x y z)
```

To allow for expansions and changes of the Crd Point in the future, please use only the following Crd Point functions for setting and accessing Crd Points.

CrdPointInit
A Crd Point structure will be returned that can be passed into CrdAddPoint, etc. *name* and *desc* must both be strings.

```
(defun CrdPointInit( x y z name desc)
(list name desc x y z)
)
```

CrdPointSetName
Sets the name of the Crd Point structure. The Crd Point is returned.

```
(defun CrdPointSetName( point name)
(cons name (cdr point))
)
```

CrdPointGetName
Gets the name of the Crd Point structure.

```
(defun CrdPointGetName( point)
(car point)
)
```

CrdPointSetDesc
Sets the description of the Crd Point structure. The Crd Point is returned.

```
(defun CrdPointSetDesc( point desc)
(cons (car point) (cons desc (cddr point)))
)
```

CrdPointGetDesc
Gets the description of the Crd Point structure.

```
(defun CrdPointGetDesc( point)
```

```
(cadr point)
)
```

CrdPointSetXYZ
Sets the x, y, z values of the Crd Point structure given a list of (x y z). The Crd Point is returned.

```
(defun CrdPointSetXYZ( point xyz)
(append (list (car point) (cadr point)) xyz)
)
```

CrdPointGetXYZ
Gets the x, y, z values of the Crd Point structure as a list of (x y z).

```
(defun CrdPointGetXYZ( point)
(cddr point)
)
```

Working with the Coordinate File

The following functions are for working with coordinate files.

CrdOpen
Opens a coordinate file with the given filename. Only one coordinate file can be open at a time through the Lisp interface. If CrdOpen is called twice, the first crd file is closed automatically.
filename – The file name of the coordinate file with required extension (.crd, .cgc, .mdb).
bOverwrite – If 1 (integer), then any existing file of the same name will be destroyed. Use nil to select default value which is 0.
crdType – See enCrdType above. This specifies the type of CRD file to create if the given name does not already exist. Use nil to select the default value which is enCrdSurvCADDAlpha.
Returns 1 (integer) if successful and 0 if there was some kind of failure. Call CrdGetLastError() to get the text message of the error.

```
(defun CrdOpen( filename bOverwrite crdType)
(cf:crdapi ''CrdOpen'' filename bOverwrite crdType)
)
```

CrdClose
Closes the current Crd file, if it is open.

```
(defun CrdClose()
(cf:crdapi ''CrdClose'')
```

```
)
```

CrdAddPoint
Adds the given Crd Point to the current open Crd File, overwriting any point with the same name that may already exist. Returns 1 (integer) if successful and 0 otherwise. Call CrdGetLastError() to get text message of error.

```
(defun CrdAddPoint( point)
(cf:crdapi ''CrdAddPoint'' point)
)
```

CrdBegin
Starts a traversal of all the points of the Crd File by resetting internal state so that CrdNext will start from beginning of file.
range – if not nil, then it must be a Carlson-style string of point names suggested by the following examples: "1-5,6,12-19" or "all". If nil, that is the same as all. The points will be returned on successive calls to CrdNext() in the order listed in the range.

```
(defun CrdBegin( range)
(cf:crdapi ''CrdBegin'' range)
)
```

CrdNext
Gets the next point in the Crd File. Returns a Crd Point if successful and nil if there are no more points or some other failure.

```
(defun CrdNext()
(cf:crdapi ''CrdNext'')
)
```

CrdGetPoint
Gets the named point from the current open Crd File. A Crd Point is returned if successful and nil is returned if the point could not be found. Call CrdGetLastError() to get text message of error.

```
(defun CrdGetPoint( name)
(cf:crdapi ''CrdGetPoint'' name)
)
```

CrdRemovePoint
Removes the named point from the current open Crd File. Returns 1 (integer) if sucessful and 0 otherwise. Call CrdGetLastError() to get text message of error.

```
(defun CrdRemovePoint( name)
(cf:crdapi ''CrdRemovePoint'' name)
```

```
)
```

CrdRemovePoints
Removes the given range of points (a string) from the current open Crd File. For example, the range could be "1-5,7,10-12".

```
(defun CrdRemovePoints( range)
(cf:crdapi ''CrdRemovePoints'' range)
)
```

CrdTestPointName
Returns nil if the point name is valid for the current Crd type. Otherwise, returns an error string describing the error.

```
(defun CrdTestPointName( name)
(cf:crdapi ''CrdTestPointName'' name)
)
```

CrdTestPoint
Returns nil if the Crd Point is valid for the current Crd type. Otherwise, returns an error string describing the error.

```
(defun CrdTestPoint( point)
(cf:crdapi ''CrdTestPoint'' point)
)
```

CrdGetLastError
Returns the error string of the result of the last operation.

```
(defun CrdGetLastError()
(cf:crdapi ''CrdGetLastError'')
)
```

CrdDeleteFile
Deletes the data file(s) underlying the Crd File and closes the Crd File. May not work if the original filename was not a full path including drive letter. Returns 1 (integer) if sucessful and 0 otherwise. Call CrdGetLastError() to get text message of error.

```
(defun CrdDeleteFile()
(cf:crdapi ''CrdDeleteFile'')
)
```

GetCrdType
Returns the crd type of the current open Crd File.

```
(defun GetCrdType()
(cf:crdapi ''GetCrdType'')
)
```

GetCrdTypeName
Returns the official name of the given crd type.

```
(defun GetCrdTypeName( enCRDType)
(cf:crdapi ''GetCrdTypeName'' enCRDType)
)
```

Example Code

```
;;;; Examples on how to use.
(CrdOpen ''junk2.crd'' nil nil)
(princ (strcat ''Created a file of type:  ''  (GetCrdTypeName
(GetCrdType)) ''.\n''))


; create a couple of points in memory.
; This first point is at coordinate 100,101,10.5 and has the
point name
; of 1012 and the description of IP.
(setq point1 (CrdPointInit 100 101 10.5 ''1012'' ''IP''))
(setq point2 point1)
(setq point2 (CrdPointSetXYZ point2 '(105 101 10.5)))
(setq point2 (CrdPointSetName point2 ''3''))
(setq point3 (CrdPointSetName point2 ''7''))

; adding a point and checking for errors.
(setq bSuccess (CrdAddPoint point1))
(if (= bSuccess 0)
(princ (strcat ''Error on point ''' (CrdPointGetName point1)
''':  ''  (CrdGetLastError))) ''.\n'')


; adding points without checking for errors.
(CrdAddPoint point2)
(CrdAddPoint point3)
```

```
; now print out the points 1 through 5
(princ ''Listing the point names.\n'')
(CrdBegin ''1-5'') ; nil or ''all'' would select all the points.
(while (setq point (CrdNext))
(princ (strcat (CrdPointGetName point) '' '' (CrdPointGetDesc
point) ''\n''))
)

(CrdDeleteFile) ;the only proper way to delete the file(s).  C&G
uses two files, for example.
(CrdClose) ;not necessary because of CrdDeleteFile, but doesn't
hurt.
(princ ''---the end---\n'')
```

DTM API

Overview

A lot of functionality of Carlson triangulation and TIN file manipulation is now available from LISP for the advanced users to use in their routines. This part of the Carlson interface is called DTM API.

API supports the older FLT file format, which stores only edge information, and the new TIN format, which is a binary format containing all the structure of triangulation and therefore is faster to load and takes less space. The file extension controls which file type is being created.

The functionality of DTM API is implemented in TRI4.ARX. It would be the responsibility of the caller to make sure that this file gets loaded by adding this line at the beginning:

```
(scload (strcat lspdir$ ''tri4''))
```

The ARX should never by unloaded by the caller.

The following is a list of currently supported functions (it can be obtained at any time by calling **(cf:dtm_api)**:
create_tin - create a TIN from selection set
draw_tin - draws a TIN as 3d faces;

tri_volume - produce volume report from 1 or 2 TINs
tri_change - modify tin using inc/exc and operators
tri_contour - contour tin using inc/exc and ini file with settings
tri_diff - produce a difference TIN from two TINs
tin_combine - produce a combined TIN performing a specified operation to elevation
tri_store_regions - create and store TIN difference
tri_apply_region - apply a specific region revision
tri_forget_region - forget all region revisions
surface_util - routines for tin surface manager

create_tin

Creates TIN from a given selection set, optionally using inside/outside logic.

Usage: **(cf:dtm_api ''create_tin'' entities_ss inclusion_ss exclusion_ss regions_ss file_name options)**

entities_ss - Selection set of all entities to be used for triangulation. Currently supported are point, line, arc, polyline, insert, circle, 3dface, solids, text, and mtext.
inclusion_ss - Selection set containing inclusion polylines if needed. Pass nil if inclusion polylines are not being used.
exclusion_ss - Selection set containing exclusion polylines if needed. Pass nil if exclusion polylines are not being used.
regions_ss - Selection set containing region polylines if needed. Pass nil if regions are not being used. Regions logic is on/off - crossing region line reverses the inside/outside state. Note: Only one of inside/outside methods can be used for one call (either inclusion/exclusion or regions).
file_name - Full path of file to be created. Extension controls a type of TIN file created.
options - Optional. String containing one or more of the following keywords, space separated:
ignore_zero - Ignore zero elevation data points.
view_error_log - In case of warnings during triangulation, bring up the report at the end.
densify - Perform ridge/valley detection and improve triangulation as needed.

draw_tin

Draws TIN file at a given layer as 3DFACEs.

Usage: **(cf:dtm_api ''draw_tin'' file_name layer_name is_road)**

file_name - Full path of file to be loaded.
layer_name - Layer name to use. If does not yet exist, new layer will be created. Color of entities is set to BYLAYER.
is_road - Optional. If set to 1 and route follows completion of Process Road Design feature it will turn on road coloring.

tri_volume

Calculates volume of the TIN within a given polyline, optionally with report generated.

Usage: **`(cf:dtm_api ''tri_volume'' inclusion_ss exclusion_ss regions_ss filename filename2|elevation is_report is_silent)`**

Return values: If successful, the function returns a list with 4 real values: cut, fill, cut area, and fill area. The volume is in cubic ft or meters and area is in square ft or meters, depending on the configuration.

inclusion_ss - Selection set containing inclusion polylines if needed. Pass nil if inclusion polylines are not being used.
exclusion_ss - Selection set containing exclusion polylines if needed. Pass nil if exclusion polylines are not being used.
regions_ss - Selection set containing region polylines if needed. Pass nil if regions are not being used. Regions logic is on/off - crossing region line reverses the inside/outside state. Note: Only one of inside/outside methods can be used for one call (either inclusion/exclusion or regions).
filename - Full path of main TIN file to be used.
filename2 - Full path of secondary TIN file to be used. If used, two surface volumes will be calculated between the first and second TINs.
elevation - Reference elevation passed as real value. If this option is used, one surface volume will be calculated between the first TIN and this reference elevation.
is_report - 0/1. Specifies whether to bring up the report with calculation results.
is_silent - 0/1. If 0 value is supplied the routine will provide no output at the command line and no progress indicators.

tri_change

Change TIN file using specified optional inclusion polylines and using one of the possible math operations. For all operations but "embed" the inclusion/exclusion polylines are offset a 0.1 so

that a reasonably sharp wall could be produced by modifications.

Usage: **(cf:dtm_api ''tri_change'' inclusion_ss exclusion_ss regions_ss filename operation value)**

inclusion_ss - Selection set containing inclusion polylines if needed. Pass nil if inclusion polylines are not being used.
exclusion_ss - Selection set containing exclusion polylines if needed. Pass nil if exclusion polylines are not being used.
regions_ss - Selection set containing region polylines if needed. Pass nil if regions are not being used. Regions logic is on/off - crossing region line reverses the inside/outside state. Note: Only one of inside/outside methods can be used for one call (either inclusion/exclusion or regions).
filename - Full path of main TIN file to be modified.
operation - keywords describing what operation is to be performed on the TIN:
add - Add a value to elevation of inside nodes.
scale - Scale elevation of inside nodes by the value.
set - Set elevation of inside nodes to the value specified.
perp - Sets elevation of nodes as if TIN is offset by value along normal at the point. The node is not moved horizontally, just elevation is adjusted.
nil - Removes inside nodes. No value is needed.
embed - No change of elevations, but the inclusion polyline is still added to TIN.

tri_contour

Contours TIN file as defined by INI file and inclusion polylines

Usage: **(cf:dtm_api ''tri_contour'' inclusion_ss exclusion_ss regions_ss tin_filename ini_filename)**

inclusion_ss - Selection set containing inclusion polylines if needed. Pass nil if inclusion polylines are not being used.
exclusion_ss - Selection set containing exclusion polylines if needed. Pass nil if exclusion polylines are not being used.
regions_ss - Selection set containing region polylines if needed. Pass nil if regions are not being used. Regions logic is on/off - crossing region line reverses the inside/outside state. Note: Only one of inside/outside methods can be used for one call (either inclusion/exclusion or regions).
tin_filename - Full path of main TIN file to be used.
ini_filename - Full path of INI file defining how contouring is performed. For list of values,

check tri4.ini in USER folder which stores values used in Triangulate and Contour function.

tri_diff

Calculates difference between two TIN files and creates combined TIN with elevation being the difference of elevations. TINs do not have to match perfectly - face intersections will be performed. Inclusion logic will be applied if needed.

Usage: **(cf:dtm_api ''tri_diff'' inclusion_ss exclusion_ss regions_ss filename1 filename2 diff_filename)**

inclusion_ss - Selection set containing inclusion polylines if needed. Pass nil if inclusion polylines are not being used.
exclusion_ss - Selection set containing exclusion polylines if needed. Pass nil if exclusion polylines are not being used.
regions_ss - Selection set containing region polylines if needed. Pass nil if regions are not being used. Regions logic is on/off - crossing region line reverses the inside/outside state. Note: Only one of inside/outside methods can be used for one call (either inclusion/exclusion or regions).
filename1, filename2 - Full path to TIN files to be used. Second TIN is subtracted from first one.
diff_filename - Full path of differential TIN file to be created.

tin_combine

Combines two TINs into one while applying one of the specified operations. First two TINs are combined into one intersecting all faces which need to be intersected and then elevations are assigned as specified.

Usage: **(cf:dtm_api ''tin_combine'' inclusion_ss exclusion_ss regions_ss filename1 filename2 merged_filename operation)**

inclusion_ss - Selection set containing inclusion polylines if needed. Pass nil if inclusion polylines are not being used.
exclusion_ss - Selection set containing exclusion polylines if needed. Pass nil if exclusion polylines are not being used.
regions_ss - Selection set containing region polylines if needed. Pass nil if regions are not being used. Regions logic is on/off - crossing region line reverses the inside/outside state. Note: Only one of inside/outside methods can be used for one call (either inclusion/exclusion or regions).

filename1, filename2 - Full path to TIN files to be used.
merged_filename - Full path to the file where results are stored.
operation - Keywords describing the operation to perform. The following operations are supported:
keep - The elevations of first TIN are used.
copy - Elevations of second TIN are used.
min - Lesser of two elevations is used.
max - Greater of two elevations is used.
join - Points inside are given elevations of first TIN, outside - second one.

tri_store_regions

Evaluates "before" and "after" TIN and stores "affected" area as a region with two revisions "0" and "1". The regions then can be applied as needed using other commands. This functionality only works with binary .TIN files.

Usage: **(cf:dtm_api ''tri_store_regions'' filename1 filename2 mark_name filename3)**

filename1, filename2 - Full path to TIN files to be used.
mark_name - String label for region to be used.
filename3 - Full path to TIN files to be Save As. If omitted, the file specified by filename1 will be replaced with resulting file.

tri_apply_region

Applies a specific pre-stored region revision, so that when TIN file is used it has that revision of the region in use.

Usage: **(cf:dtm_api ''tri_apply_region'' filename mark_name revision)**

filename1 - Full path to TIN file to be modified.
mark_name - String label for region to be used.
revision - Integer. Optional ID of revision to apply. If omitted, the latest revision of the region is used.

tri_forget_region

Removes any knowledge of a specific pre-stored region revision from TIN file. Optionally remove triangles found in the region from the TIN.

Usage: **(cf:dtm_api ''tri_forget_region'' filename mark_name remove_first)**

filename - Full path to TIN file to be modified.
mark_name - String label for region to be used.
remove_first- 0/1. Optional flag indicating whether region triangles should be removed, leaving a hole in the TIN.

surface_util

Utilities for dealing with surfaces stored in the drawing.

Usage: **(cf:dtm_api ''surface_util'' filename operation)**

filename - Full path to TIN file to be modified.
operation - Keywords describing the operation to perform. The following operations are supported:
check - Check if TIN is used in one of the surfaces. Returns 0 or 1 depending on outcome.
process - Apply current surface parameters to TIN file. This function should be used to update surface in the drawing after TIN has been modified.

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